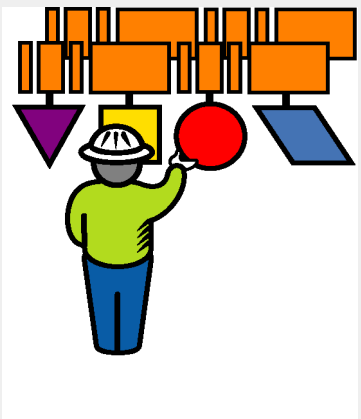
Allen-Bradley

ControlNet Ex Media System
(Cat. No. 1797 Series)

Planning and Installation Manual



Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Reproduction of the contents of this copyrighted publication, in whole or in part, without written permission of Allen-Bradley Company, Inc., is prohibited.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

ControlNet is a trademark of ControlNet International Ltd.

ControlNet Ex, PLC, PLC-5/20C, and PLC-5/40C are trademarks of Rockwell Automation.

About This Manual

Manual Contents

Use this manual to plan and install a ControlNet Ex™ media system. This manual describes the required components of an intrinsically safe cable system and how to plan for and install these required components.

This manual is specifically targeted at configuring a ControlNet Ex system. However, since a ControlNet Ex system and a ControlNet™ system can be linked, it may be necessary to introduce and refer to concepts on the ControlNet side of the network.

Some items employed on the ControlNet system may not be possible with a ControlNet Ex system. Much work has been done to make the installation methods and equipment available on the ControlNet Ex systems the same as those on the ControlNet systems. However, some differences do exist. As you read, please make special note of these differences.

To:	Read chapter:
Understand the ControlNet Ex Coax cable system	1
Plan a ControlNet Ex Coax cable system	2
Install a ControlNet Ex Coax cable system	3

For reference on:	See appendix:
Mounting dimensions (taps, universal mounting bracket, and repeater)	A
Adjusting the cable strip tool	B

Important: We assume that you have a fundamental understanding of electronics and electrical codes.

Abbreviations

Abbreviation	Means
PVC cable	polyvinyl chloride cable
FEP cable	fluorinated ethylene propylene cable
PLC processor	Allen-Bradley programmable logic controller
	network continues (other nodes not shown)

Related Publications

Catalog Number	Publication	Publication Number
1797 Series	FLEX Ex Product Data	1797-2.1
1797 Series	FLEX Ex System Overview	1797-2.2
1797-TB3	FLEX Ex Terminal Base Unit Installation Instructions	1797-5.1
1797-TB3S	FLEX Ex Spring Clamp Terminal Base Unit Installation Instructions	1797-5.2
1797-OE8	FLEX Ex 8 Output Analog Module Installation Instructions	1797-5.3
1797-IRT8	FLEX Ex RTD/Thermocouple/mV Module Installation Instructions	1797-5.4
1797-IE8	FLEX Ex 8 Input Analog Module Installation Instructions	1797-5.5
1797-OB4D	FLEX Ex 4 Output Module Installation Instructions	1797-5.6
1797-IBN16	FLEX Ex NAMUR Input Module Installation Instructions	1797-5.7
1797-IJ2	FLEX Ex 2 Frequency Input Module Installation Instructions	1797-5.9
1797-PS2E-PS2N	FLEX Ex Power Supplies Installation Instructions	1797-5.12
1797-ACNR15/B	ControlNet Ex Adapter Installation Instructions	1797-5.14
1797-RPA, -RPFM	ControlNet Ex Fiber Repeater Hub Installation Instructions	1797-5.15
1797-TPR, -TPS, -TPYR, -TPYS	ControlNet Ex Coax Tap Installation Instructions	1797-5.18
1797-CE1S, -CE3S, -CEFTE, -CEFTN	FLEX Ex Extender Cables Installation Instructions	1797-5.20
1797-EXMK	FLEX EX Marker Kit Installation Instructions	1797-5.23
1797-IE8, -OE8	FLEX Ex Analog Modules User Manual	1797-6.5.1
1797-IRT8	FLEX Ex RTD/Thermocouple/mV Module User Manual	1797-6.5.2
1797-IJ2	FLEX Ex 2 Frequency Input Module User Manual	1797-6.5.4

Overview Of The ControlNet Ex Media System

Chapter 1

Contents 1-1
Understanding The ControlNet Ex Cable System. 1-1
ControlNet Ex System Diagram 1-3
Understanding ControlNet Ex Components 1-6
Nodes 1-6
Taps 1-7
Trunk Cable. 1-7
Cable Connectors 1-8
Trunk Terminator. 1-8
Tap Terminator 1-8
Segments 1-9
Fiber Repeater Hubs. 1-9
Network 1-10
Insulators. 1-10
Next. 1-10

Planning A ControlNet Ex Cable System

Chapter 2

Contents 2-1
Determining How Many Taps You Need. 2-1
Connecting Programming Devices in Non-Hazardous Areas 2-3
Cable Type 2-3
Determining Trunk-Cable Section Lengths. 2-3
Determining How Many Trunk Terminators You Need 2-5
Determining If You Need Coax Repeaters in Non-Hazardous Areas 2-5
Determining What Type Of Connectors You Need. 2-5
Using Redundant Media in a Hazardous Area 2-6
Application Considerations 2-9
General Wiring Guidelines 2-11
Wiring External To Enclosures 2-11
Wiring Inside Enclosures. 2-11
Surge Suppression 2-12
Ferrite Beads. 2-12
Ordering Components. 2-13
General Planning 2-13
Segment Planning. 2-13
Network Planning. 2-13
Ordering Parts. 2-14
Next. 2-14

Installing A ControlNet Ex Cable System

Chapter 3

Contents 3-1
Installing The Trunk Cable 3-1
Wiring External To Enclosures 3-1
Wiring Inside Enclosures. 3-1
Mounting The Taps. 3-2
Selecting Where To Mount The Taps 3-2
Mounting The Taps 3-2

Mounting A Tap Using A Universal Mounting Bracket 3-3
Mounting A Tap Through The Body Holes 3-5
Specifications 3-5
Installing Fiber Hubs 3-5
Installation in Zone 1 3-5
Electrostatic Charge 3-6
European Community Directive Compliance 3-6
EMC Directive 3-6
Ex Directive 3-6
Inputs/Outputs 3-6
Selecting Where To Mount Fiber Repeater Hubs 3-7
Mount the Fiber Repeater Hub 3-7
Connecting the Fiber Repeater Hub to a ControlNet Ex Network 3-9
Installing Cable Connectors 3-11
Collecting Your Tools 3-11
Stripping The Cable 3-12
Testing For Electrical Shorts And Continuity 3-16
Attaching The Connectors To The Cable 3-17
Testing For Electrical Shorts and Continuity 3-20
Connecting Cable Sections 3-21
Terminating Segments 3-21
Connecting Devices 3-22

Mounting Dimensions

Appendix A

Contents A-1
Taps A-1
Universal Mounting Bracket A-2
. . . . . A-2

Adjusting The Cable Strip Tool

Appendix B

Contents B-1
Calibrating The Cutting Blades B-1
Reversing/Replacing
The Cutting Blades B-3
Changing The Memory Blade Holder B-5
Electrostatic Charge B-6

Overview Of The ControlNet Ex Media System

Contents

Read this chapter to familiarize yourself with the ControlNet Ex media system. This system is an intrinsically safe (IS) system specifically designed for use in hazardous areas.

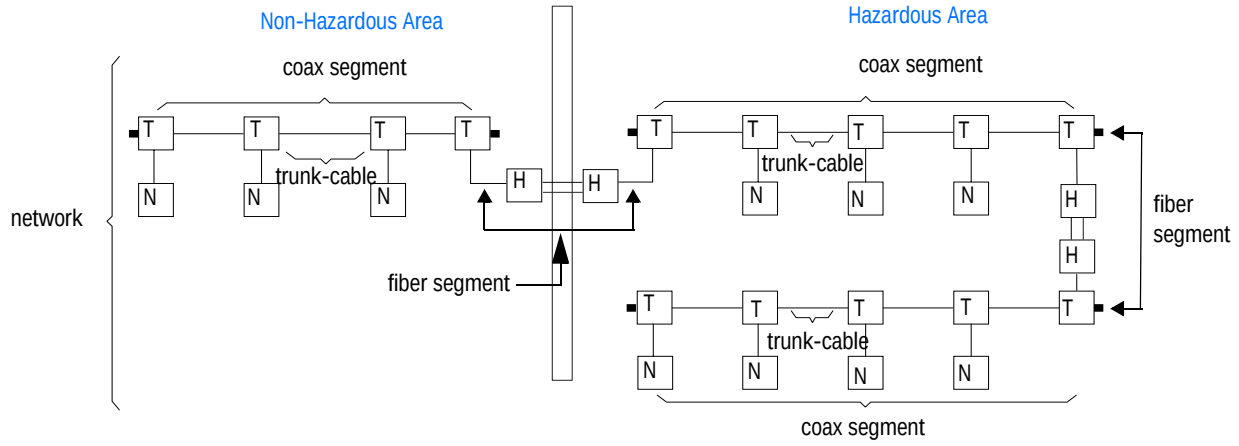
Important: This publication describes the planning and installation of a ControlNet Ex media system in a hazardous area. Refer to publication 1786-6.2.1 for information on planning and installing a ControlNet media system in a non-hazardous environment.

ATTENTION: The ControlNet Ex media system cannot be used in an intrinsically safe environment after it has been exposed to non-intrinsically safe signals.

Understanding The ControlNet Ex Cable System

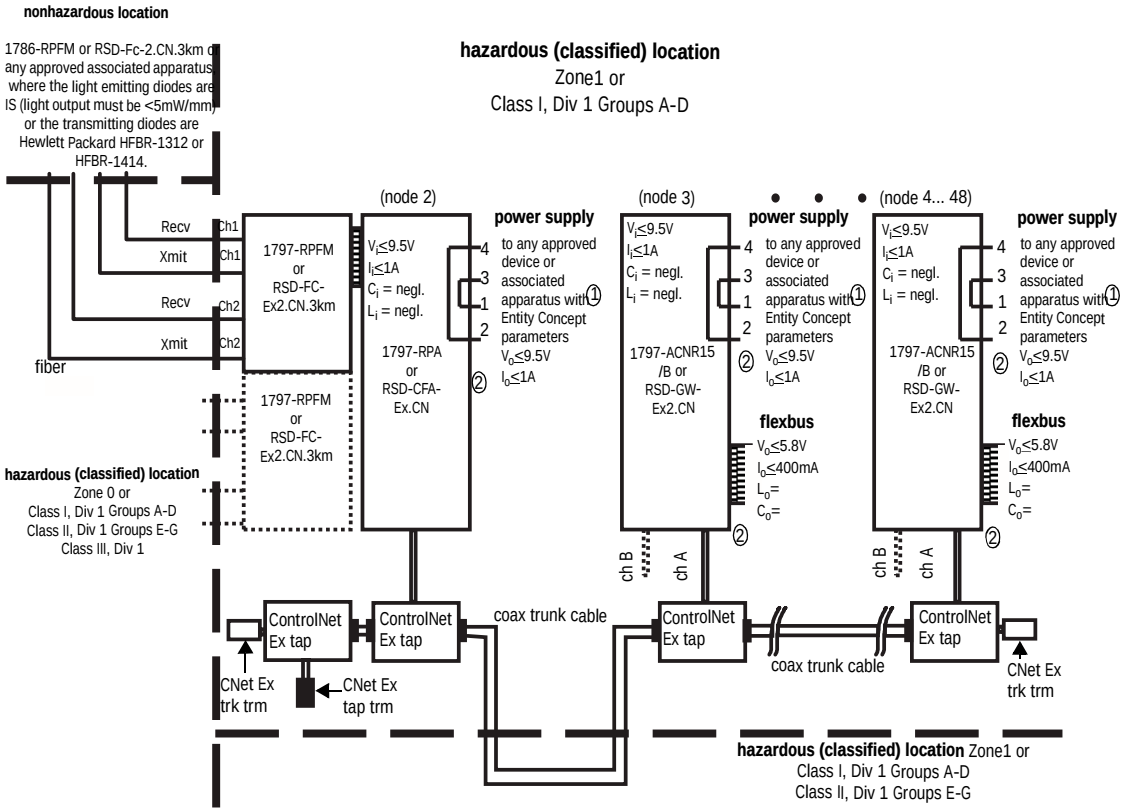
The ControlNet Ex media system gives you the flexibility to design a communication network for your particular application. To take full advantage of this flexibility, you should spend sufficient time planning how to install your network **before** assembling any of the hardware.

Use the following figure and term definitions to understand the ControlNet Ex media system.



Term	Means	Term	Means
network	1. a collection of connected nodes — 2. a collection of nodes with unique addresses in the range of 1-99 3.the connection paths between any pair of devices may include repeaters and bridges	tap T	the connection between any device and the ControlNet Ex or ControlNet media system
segment	trunk-cable sections connected via taps with terminators at each end and with no repeaters	node N	any physical device connecting to the ControlNet Ex or ControlNet media system which requires a network address in order to function on the network — a network may contain a maximum of 99 nodes *this address must be in the range of **1 - 99** and be unique to that network*
trunk cable	the bus or central part of a media system	trunk terminator	a 75Ω resistor mounted in a BNC plug
trunk-cable section	a length of a cable between any two taps	tap terminator D	terminates a tap drop-cable that has yet to be connected to a node with a “dummy” node.
fiber repeater hub H	consists of a fiber repeater and fiber adapter components that reconstruct and retransmit all traffic it hears on one fiber or coax segment side to another coax or fiber segment side		

ControlNet Ex System Diagram



Describing the ControlNet Ex System Diagram

A maximum of 48 ControlNet Ex™ nodes may be connected together by coax cable and taps.

The fiber media of the 1797-RPFM can be installed in a hazardous location (Zone 0 and Zone 1) to connect two 1797-RPFM modules or they can be installed through different locations into the non-hazardous location to connect the 1797-RPFM with any approved associated apparatus.

All cables and fiber media that are not light blue must be marked as IS using the 1797-EXMK marking kit or other locally approved IS identification and/or segregation method.

During the installation of the ControlNet Ex system, all metallic parts must be isolated to prevent an earth connection (high voltage withstanding of isolating material must be > 500V ac).

1 = The entity concept allows interconnection of IS apparatus with associated apparatus not specially examined in combination as a system when the approved values of V_{oc} and I_{sc} for the associated apparatus are $\leq V_{max}$ and I_{max} for the IS apparatus and the approved values of C_a and L_a for the associated apparatus are > $C_i + C_{cable}$ and $L_i + L_{cable}$ respectively for the IS apparatus.

2 = Wiring methods must be in accordance with the National Electric Code, NFPA 70, Article 504 and ANSI/ISA-RP 12.6.

System Drawing Name	Catalog Number	Catalog Name	Description
1797-RPA	1797-RPA	ControlNet Ex Modular Repeater Adapter	Represents one ControlNet Ex node and must be connected to a coax trunk cable by 1797-TPx
1797-RPFM	1797-RPFM	ControlNet Ex Fiber Repeater Module, Medium Distance	Allows connection of a maximum of two devices per 1797-RPA and is powered directly by 1797-RPA
1797-ACNR15/B	1797-ACNR15/B	Redundant Media ControlNet Ex Adapter	Represents one ControlNet Ex node and must be connected to a coax trunk cable by 1797-TPx -each one with two redundant output channels that are connected to different ControlNet Ex networks (coax cables and 1797-TPx)
CNet Ex Tap Trm	1797-TCAP	ControlNet Ex Tap (Dummy) Terminator	Represents one ControlNet Ex node and is a simple capacitor (56pF) with a coax connector
ControlNet Ex Tap	1797-TPx	ControlNet Ex Coax Tap	Four types of connections available: S (straight t-tap), R (right angle t-tap), YS (straight y-tap), and YR (right angle y-tap) - a maximum of 48 taps can be connected together by coax trunk cable
CNet Ex Trk Trm	1797-XT	ControlNet Ex Trunk Terminator	Simple resistor (75Ω) with coax connector that must be on each end of the ControlNet Ex coax trunk for termination
Coax Trunk Cable	1797-RG6	Quad-Shield, RG-6 75Ω Coax Trunk Cable	Maximum (functional) length between 2 1797-TPx is 3280ft (1000m) - each 1797-TPx reduces the (functional) coax cable length by 53.4ft (16.3m)
None	None	Standard Coax Trunk Cable BNC Couplers	Different standard cable couplers, 90^0, 180^0, etc.

European Community Directive Compliance

The ControlNet Ex System has the CE mark it is approved for installation within the European Community or EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

- The ControlNet Ex System is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:
- EN50081-2
- EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN50082-2
- EMC - Generic Immunity Standard, Part 2 - Industrial Environment

The ControlNet Ex System is intended for use in an industrial environment.

Ex Directive

The ControlNet Ex System is tested to meet the Council Directive 94/9 EC (ATEX 100a) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres by applying the following standards:

- EN50014:1992, Electrical Apparatus for Potentially Explosive Atmospheres
- EN50020:1994, Electrical Apparatus for Potentially Explosive Atmospheres - Intrinsic Safety “i”
- EN50039:1980, Electrical Apparatus for Potentially Explosive Atmospheres - Intrinsically Safe Electrical Systems “i”
- pr EN50284:1997, Special requirements for construction, test, and marking of electrical apparatus of equipment group II, category 1 G

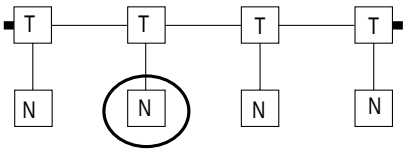
Understanding ControlNet Ex Components

The ControlNet Ex media system is comprised of these components:

- nodes
- taps[1]
- trunk cable[1]
- cable connectors[1]
- terminators[1]
- segments
- fiber repeater hubs[1]
- tap terminator
- network
- insulators

Nodes

Nodes are defined as physical devices connected to the ControlNet Ex media system that require a network address in order to function on the network.

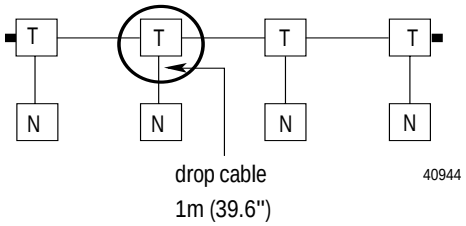


40953

[1] For information on purchasing these components see the Allen-Bradley ControlNet Cable System Component List publication AG-2.2.

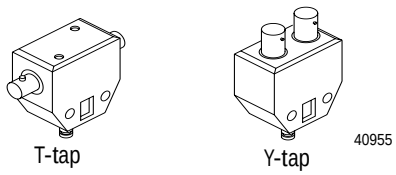
Taps

Taps connect each node on a network to the coax media system via an integral 1m (39.6”) drop cable.

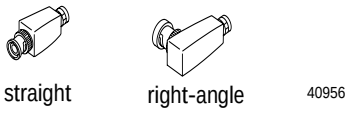


There are four taps available with a:

- T or Y placement of BNC connectors



Important: straight or right angle connector on the drop media



ATTENTION: Only intrinsically safe taps may be used in a ControlNet Ex media system. Intrinsically safe taps are marked “ControlNet Ex Tap.”

See page 2-1 for detailed information on taps.

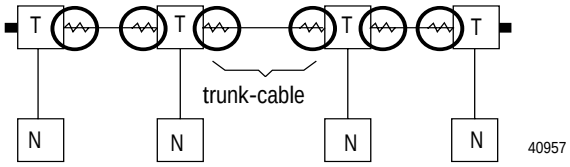
Trunk Cable

The trunk cable is the bus, or central part of the ControlNet Ex coax media system. The trunk cable is composed of multiple sections of cable. The standard cable that can be used to construct trunk-cable sections is quad shield RG-6 type coax.

ATTENTION: You must use the ControlNet Ex Trunk Cable 1797-RG6 or the Belden 3092A quad shield RG-6 type coax.

Cable Connectors

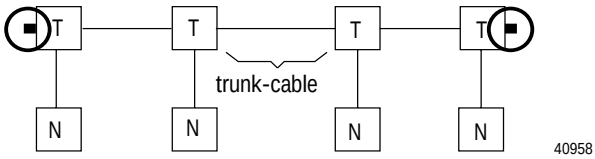
A cable connector (cat. no. 1786-BNC) may be used to attach coax trunk-cable sections to the tap's BNC connector.



Optional Connectors
Allen-Bradley also offers optional cable connectors for use in your network configuration. See page 2-5 for available connectors.

Trunk Terminator

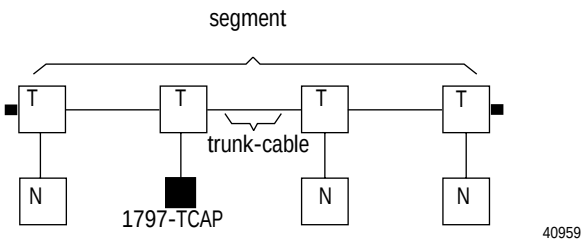
A 75-Ω terminator (cat. no. 1797-XT) **must** be installed on the tap at each end of a segment.



ATTENTION: Only intrinsically safe trunk terminators may be used in a ControlNet Ex media system. Intrinsically safe trunk terminators are marked "CNet Trk Trm."

Tap Terminator

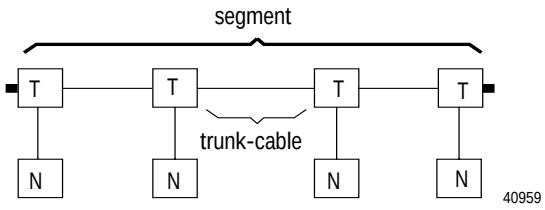
A tap terminator (cat. no. 1797-TCAP) is available to terminate unused taps, which may be in your system for future expansion.



ATTENTION: Only intrinsically safe tap terminators may be used in a ControlNet Ex media system. Intrinsically safe tap terminators are marked "CNet Tap Trm."

Segments

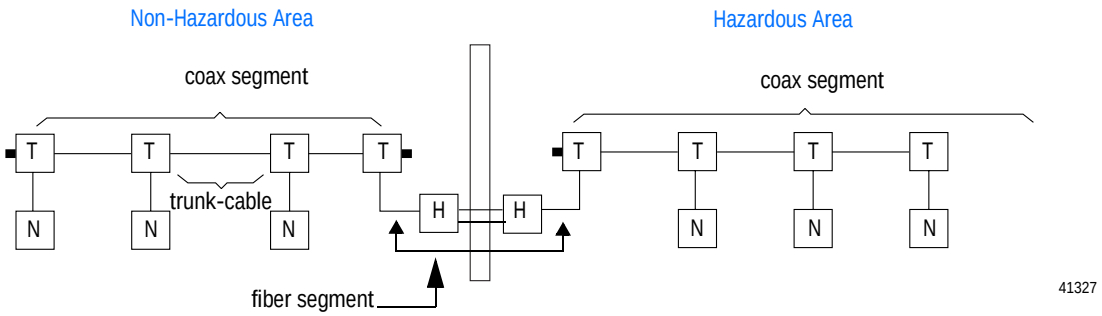
A segment is a collection of coax trunk-cable sections, taps and two terminators.



The total allowable length of a segment depends upon the **number of taps** in your segment and the coax cable type used. See page 2-3 for detailed information.

Fiber Repeater Hubs

You must use a fiber repeater hub as the segment from your non-hazardous area to your hazardous area. Fiber repeater hubs increase the number of taps, extend the total length of your segment, or create a star configuration (go off in multiple directions from one point). The number of fiber repeater hubs and cable length total is limited depending on your network topology.

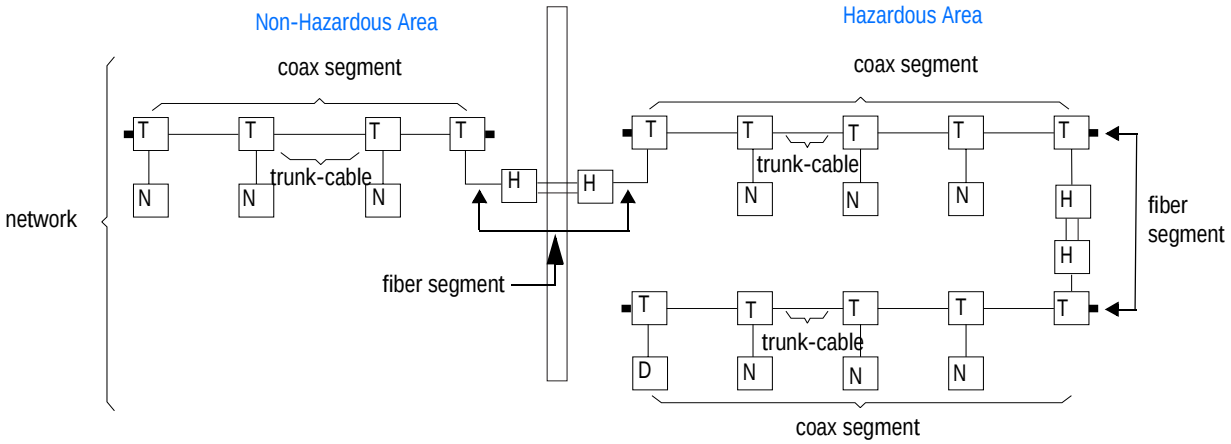


When you insert a fiber repeater hub into your cable system, you create a new segment. The same restrictions on the number of taps and cable length apply to this new segment.

ATTENTION: Only the intrinsically safe 1797 version of fiber repeater hub may be used in the hazardous area.

Network

A network is the collection of nodes connected together by fiber repeater hubs.



Insulators

The ControlNet Ex media system must maintain isolation from ground. Many of the connectors etc. have metal parts. These parts must be insulated by 500V insulation material from ground contact. Insulators are provided with ControlNet Ex media system components that require insulation. For example, the Controlnet Ex taps are supplied with an insulator kit.

A large variety of BNC connectors are available for use with the ControlNet Ex media system. As a result, insulators for all types of connectors are not available. In these cases wrapping the exposed metal with 500V insulation electrical tape is acceptable.

Two insulator kits are available:

- 1797-Boot, provides standard BNC trunk cable insulators
- 1797-INS, provides a variety of the preformed boots and insulators used with the ControlNet Ex system products

Next

Now that you have a general understanding of the ControlNet Ex media system, you are ready to design a ControlNet Ex media system for your specific requirements. Go to chapter 2.

Planning A ControlNet Ex Cable System

Contents

Use this chapter to determine your network requirements.

To determine:	See page:
how many taps you need	2-1
how to connect your programming device	2-3
what type of cable you need	2-3
trunk-cable section lengths	2-3
determine how many terminators you need	2-5
if you need coax repeaters	2-6
what type of connectors you need	2-6
if you will use redundant media	2-7
application considerations	2-10
components to order (summary)	2-12

After reading this chapter, consult engineering drawings of your facility for specific information concerning the best location for installing your network.

Important: The ControlNet Ex cable system is a ground-isolated network. Proper selection of cable, connectors, accessories, such as the blue insulators, and installation techniques are necessary to make sure it is not accidentally grounded. If conditions occur where other means are needed to ensure no metal to ground connections, items like blue tape can be used. Any accessories should have a dielectric rating of greater than 500 V.

Determining How Many Taps You Need

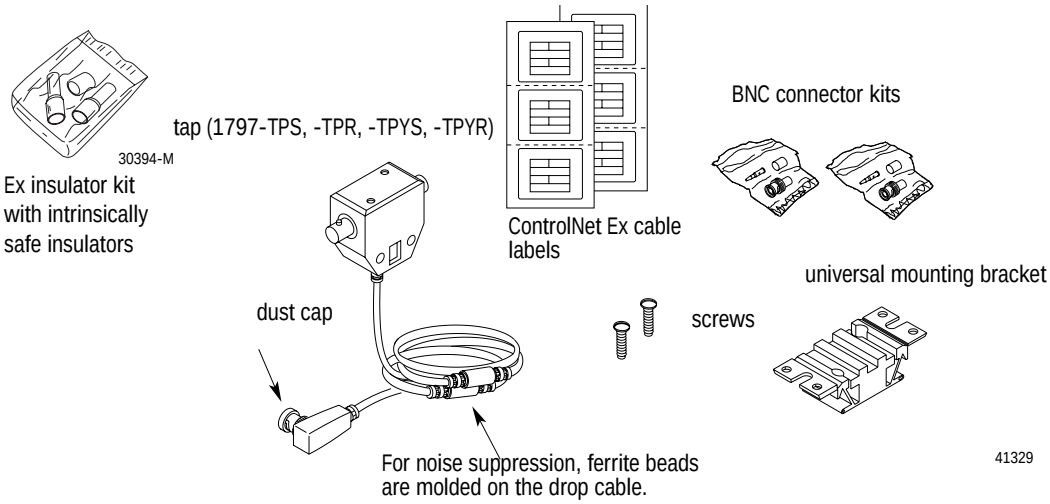
The number of taps you need depends on the number of devices you want to connect to the network. You need a tap for each node and fiber hub on a segment.

If you plan to add nodes at a later date, you should consider ordering and installing the cable and connectors for these additional nodes when you install the initial network. This will minimize disruption to the network during operation.

Important: A disconnected drop cable can cause noise on the network. Because of this, we recommend having **only one** unconnected drop cable per segment for maintenance purposes. Be sure to keep the dust cap on any unconnected drop cable. If your cable system requires more than one unconnected drop cable, unused drop cables should be terminated with a tap terminator (1797-TCAP).

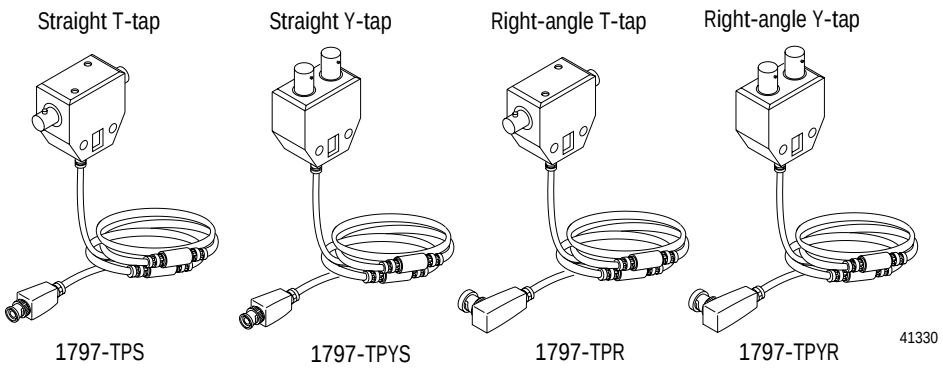
If you are planning future installation of additional nodes, do not install the tap. Instead, install a BNC bullet connector See page 2-6 for more information.

Each tap kit contains:



Important: The light-blue intrinsically safe insulators and dust caps are provided to cover exposed metal parts. Use of these items is required for instrinsically safe system certification by local agencies.

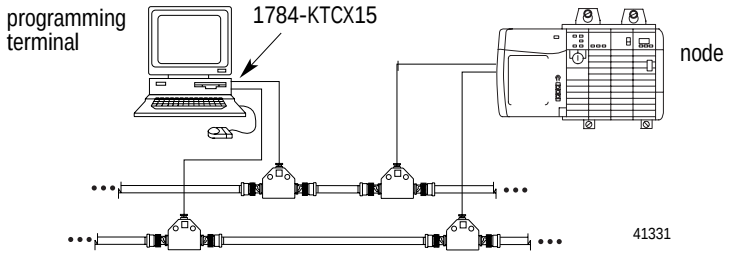
These tap kits are available:



Connecting Programming Devices in Non-Hazardous Areas

Programming devices in non-hazardous areas may be connected to the ControlNet cable system through a 1784-KTCX15 communication card. The communication card is connected to the network using a ControlNet tap.

Using a 1784-KTCX15 communication card on coax media



Coax Cable Type

A 1797-RG6 or Belden 3092A quad shield RG-6 coax must be used as the ControlNet Ex trunk cable.

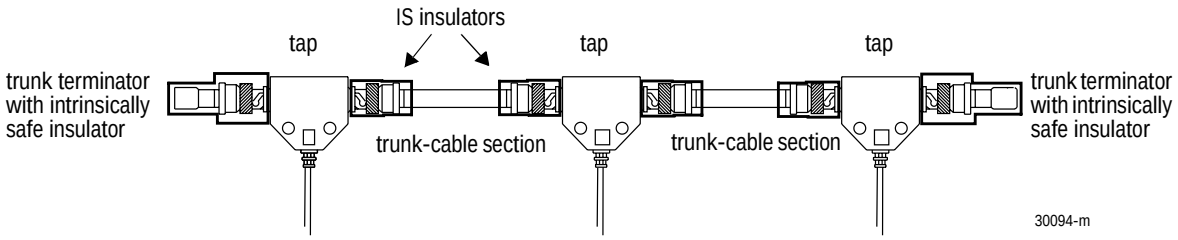
Fiber Media Type

- Fiber type 62.5/125µ
- Connector type ST (plastic or ceramic)
- Operating wavelength 1300nm
- Optical power budget 13.3dB

Important: You should install all wiring for your ControlNet Ex cable system in accordance with the regulations contained in applicable country codes, state codes, and applicable municipal codes (e.g. National Electric Code). All metal connectors must be insulated from the ground. Use blue ControlNet cable or the ControlNet Ex Cable Marking Kit (1797-EXMK) to mark cable as intrinsically safe.

Determining Trunk-Cable Section Lengths

A segment is comprised of several sections of trunk cable separated by taps. The total cable length of a segment is equal to the sum of all of the trunk-cable sections.

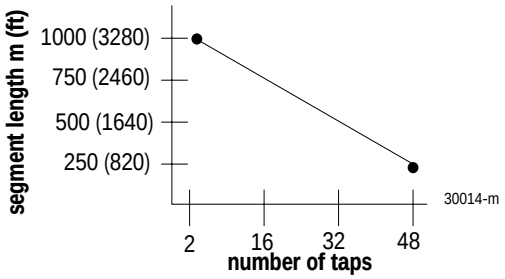


Important: When determining the cable length of trunk-cable sections, make sure you measure the actual cable path as it is routed in your network. Consider vertical dimensions as well as horizontal dimensions. You should always calculate the three-dimensional routing path distance when determining cable lengths.
Also make sure to cover all exposed metal with either the intrinsically safe insulators or other forms of insulation.

Select the shortest path for routing the cable to minimize the amount of cable you need. The specific details of planning such a cable route depends upon the needs of your network.

The total allowable length of a segment containing standard RG-6 quad shield cable depends upon the **number of taps** in your segment. There is **no minimum** trunk-cable section length requirement. The maximum allowable total length of a segment is 1,000m (3,280ft) with two taps connected. Each additional tap decreases the maximum length of the segment by 16.3m (53ft). The maximum number of taps allowed on a segment is 48 with a maximum length of 250m (820ft).

maximum allowable segment length =
1000m (3280ft) - 16.3m (53.4ft) X [number of taps - 2]



Example

If your segment requires 10 taps, the maximum segment length is:

1000m (3280ft) - 16.3m (53.5ft) x [10 - 2]
1000m (3280ft) - 130.4m (427.7ft)) = **869.6m (2852.3ft)**

An allowable total length of RG-6 cable segment in your application can be determined using the equation below. Each additional tap decreases the maximum length of the segment. The maximum number of taps allowed on a segment is 48. Each additional tap decreases the maximum length of the segment.

maximum allowable segment length of cable =

$$\frac{\text{(20.29 db - number of taps in segment *.32 db)}}{\text{cable attenuation @ 10MHz per 304 m (1000 ft)}} \text{ X 304m (1000ft)}$$

Note: Cable attenuation is defined as the signal loss measured at 10 MHz per 1000 ft (304 m) of cable. Cable attenuation for ControlNet Ex cables are listed in publication AG-2.2, ControlNet Ex Cable Systems Component List.

Example

If your segment requires 3 taps using 1797-RG6 cable, the maximum segment length is:

([20.29 db - 3*.32 db] / 5.99 db] * 304)
(19.33 db / 5.99 db) * 304 = 982 m (3227ft)

The total trunk-cable length or number of taps can be increased by installing a fiber repeater hub on the segment. This creates another segment.

Estimating Fiber Media Lengths

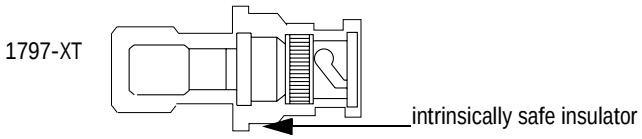
The maximum length of a fiber media section for the 1797-RPFM is dependent on the quality of the fiber, number of splices, and the number of connectors. The total attenuation for a cable section **must** be less than 13.3dB.

Typically cable attenuation for a wavelength of 1300nm is less than 1.5dB/km.

Important: Avoid jointing your cable as much as necessary. Connectors can cause considerable attenuation and limit the maximum length of your system. Be sure to check the attenuation of different cable sections after the cable is installed.

Determining How Many Trunk Terminators You Need

You must use 75Ω trunk terminators equipped with intrinsically safe insulators (cat. no. 1797-XT) at the end of each segment for the ControlNet Ex cable system.



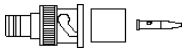
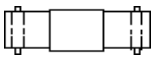
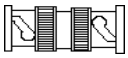
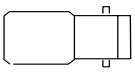
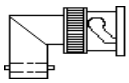
After you have determined how many segments will be in your network, multiply this number by two to determine how many terminators you will need for your network.

Be sure to cover the exposed metal using the intrinsically safe insulator provided with each terminator in order to comply with intrinsic safety standards.

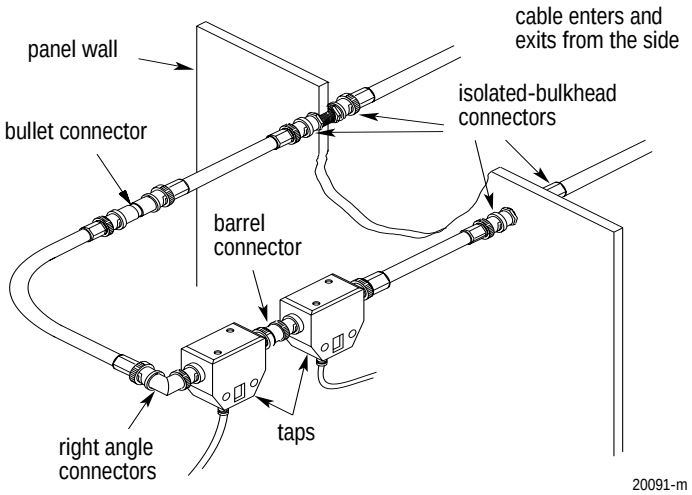
Determining If You Need Coax Repeaters in Non-Hazardous Areas

Refer to the ControlNet Coax Planning and Installation manual, publication 1786-6.2.1, to determine if your application would require coax repeaters in the non-hazardous areas.

Determining What Type Of Connectors You Need

Use this BNC connector:	To:	Cat. No.
cable connector 	attach trunk-cable sections to a tap's BNC connector	1786-BNC
Use this optional BNC connector:	**To:**	**Cat. No.**
bullet (jack-to-jack) 	reserve a space in the trunk cable for future installation of a tap or to splice a trunk cable	1786-BNCJ
barrel (plug-to-plug) 	connect two adjacent taps without a trunk-cable section between them	1786-BNCP
isolated-bulkhead (jack-to-jack)	go through grounded panel walls while maintaining the shield isolation of the trunk-cable.	1786-BNCJI
tap terminator 	cap off installed taps that have yet to be connected to a node	1797-TCAP
right angle (jack-to-plug) 	provide a 90° bend in your cable (prevent bending your cable excessively). See Chapter 3 for the bend radius specification.	See the Allen-Bradley *ControlNet Media System Component List* (publication AG-2.2) for the part number.

In this example, ControlNet Ex cable:
- enters and exits the panel enclosure from the side using isolated-bulkhead connectors
- contains two adjacent taps connected by a barrel connector
- reserves one future tap location with a bullet connector
- makes a sharp bend with a right angle connector



ATTENTION: Do not let any metallic surfaces on the BNC connectors, plugs, or optional accessories touch grounded metallic surfaces. This contact could cause noise on the network. All exposed metal must be covered with either intrinsically safe blue insulators or another form of insulation, such as tape with a 500V rating.

Important: If you are installing a bullet connector for future tap installations, count the bullet as one of the tap allotments on your segment (and decrease the maximum allowable cable length by 16.3m [53.5ft]).
This helps you avoid reconfiguring your network when you install the tap.

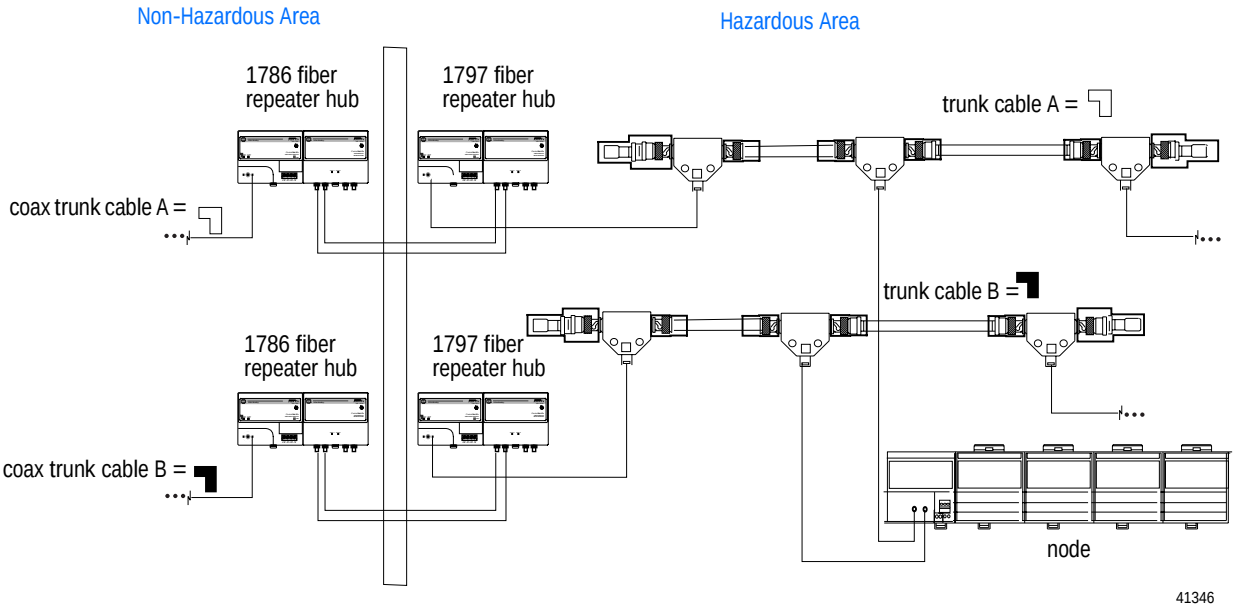
Using Redundant Media in a Hazardous Area

You can run a second trunk cable between your ControlNet Ex nodes for redundant media. With redundant media, nodes send signals on two separate segments. The receiving node compares the quality of the two signals and accepts the better signal to permit use of the best signal. This also provides a backup cable should one cable fail.

Trunk cables on a redundant cable network are defined by the segment number and the redundant trunk-cable letter.

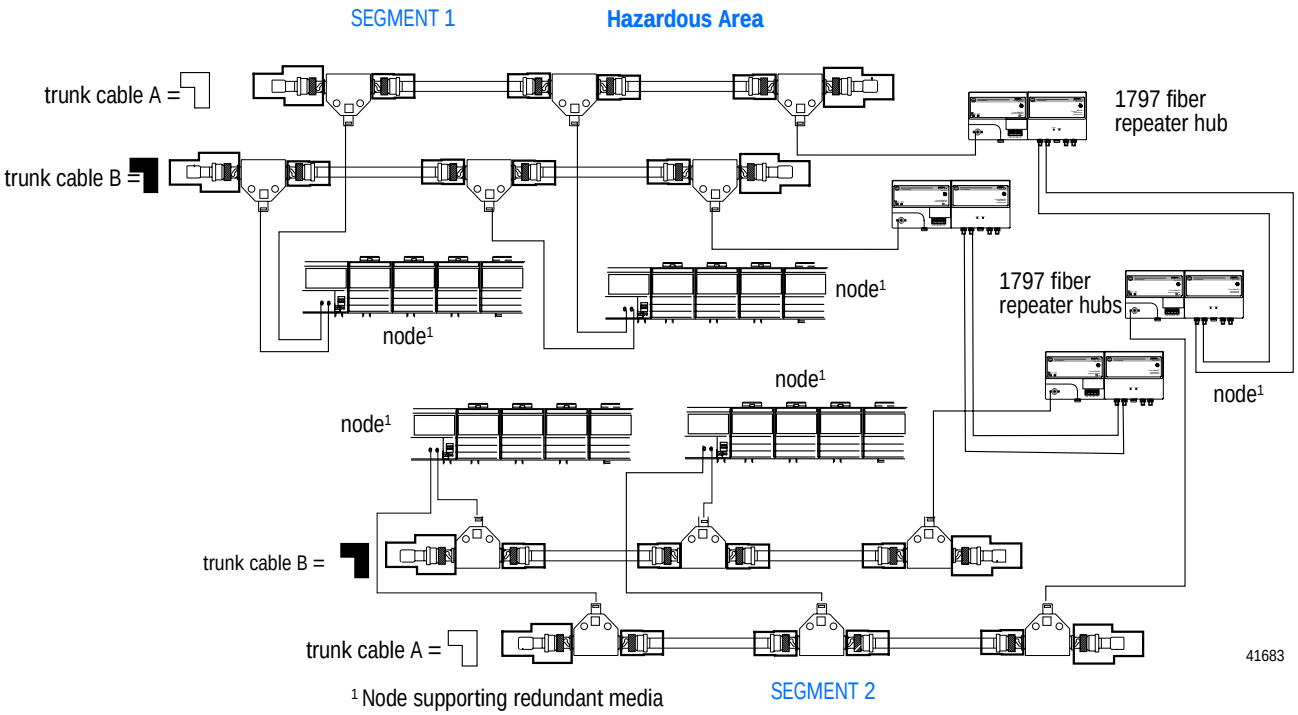
Actual ControlNet Ex products are labeled with these icons (the shaded icon representing redundant media).

In this figure, the redundant cable trunk cable is trunk cable B.

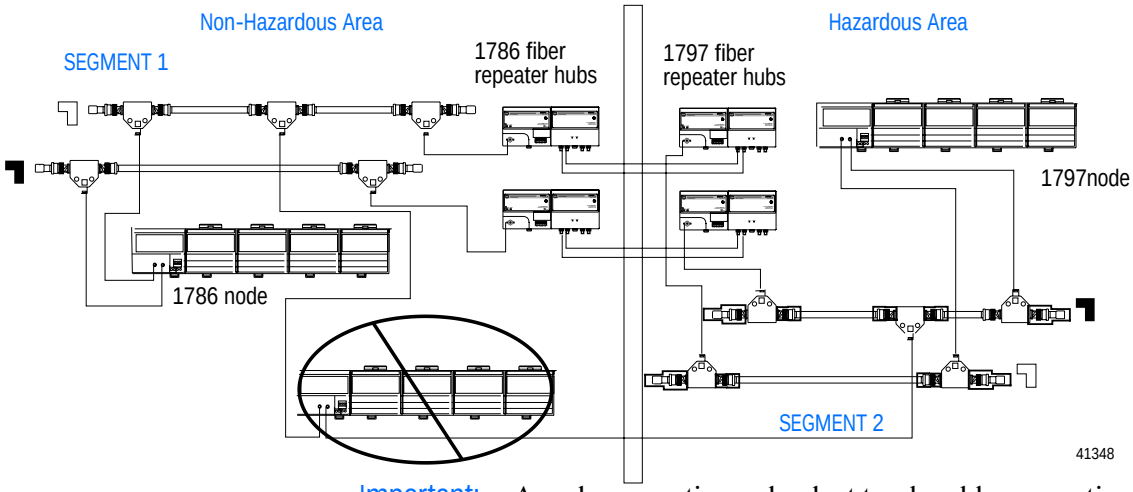


Observe these guidelines when planning a redundant media system in a hazardous area.

- Route the two trunk cables (trunk cable A and trunk cable B) differently to reduce the chance of both cables being damaged at the same time.
- Each node on a redundant-cable network must support redundant coax connections and be connected to both trunk cables at all times. Any nodes connected to only one side of a redundant-cable network will result in media errors on the unconnected trunk cable.
- Install the cable system so that the trunk cables at any physical device location can be easily identified and labeled with the appropriate icon or letter. *Each redundant ControlNet Ex device is labeled so you can connect it to the corresponding trunk cable.*
- Both trunk cables (trunk cable A and trunk cable B) of a redundant-cable network must have identical configurations. Each segment must contain the same number of taps, nodes and fiber repeaters. *Connect nodes and fiber repeaters in the same relative sequence on both trunk cables.*
- Each side of a redundant-cable network may contain different lengths of cable. The total difference in length between the two trunk cables of a redundant-cable network must not exceed 800m (2640ft).



- Avoid connecting a single node's redundant trunk cable connections on different segments; this will cause erratic operation.



Important: A node supporting redundant trunk-cable connections will function even if trunk cable A is connected to the B connector on the node and vice-versa. This makes cable fault indications (on the hardware or in software) difficult to interpret and makes locating a bad cable segment very difficult.

ATTENTION: Never connect parts of a ControlNet cable system to those of a ControlNet Ex cable system. The 1786 fiber repeater hub and 1797 fiber repeater hub are used to isolate the two sections of a ControlNet network.

ATTENTION: ControlNet Ex products cannot be used in an intrinsically safe environment after they have been exposed to non-intrinsically safe signals.

Application Considerations

The following guidelines coincide with the guidelines for "the installation of electrical equipment to minimize electrical noise inputs to controllers from external sources" in IEEE standard 518-1982. When planning your cable system there are certain installation considerations depending on your application.
There are three categories of conductors:

Category:	Includes:
1	• ac power lines • high-power digital ac I/O lines • high-power digital dc I/O lines • power connections (conductors) from motion drives to motors
2	• analog I/O lines and dc power lines for analog circuits • low-power digital ac/dc I/O lines • low-power digital I/O lines • ControlNet Ex communication cables
3	• low-voltage dc power lines • communication cables to connect between system components within the same enclosure

ATTENTION: These guidelines apply only to noise coupling. Intrinsic safety requirements for cable mounting are of the highest priority.

General Wiring Guidelines

Follow these guidelines with regard to noise coupling. Intrinsic safety requirements should prevent most or all of these situations from occurring. They are provided as a general reference for wiring.

- If it must cross power feed lines, it should do so at right angles.
- Route at least 1.5m (5ft) from high-voltage enclosures, or sources of rf/microwave radiation.
- If the conductor is in a metal wireway or conduit, each section of that wireway or conduit must be bonded to each adjacent section so that it has electrical continuity along its entire length, and must be bonded to the enclosure at the entry point.

For more information on general wiring guidelines, see the *Industrial Automation Wiring and Grounding Guidelines* (publication 1770-4.1).

Wiring External To Enclosures

Cables that run outside protective enclosures are relatively long. To minimize cross-talk from nearby cables, it is good practice to maintain maximum separation between the ControlNet Ex cable and other potential noise conductors. You should route your cable following these guidelines:

Cable in a contiguous metallic wireway or conduit?	Route your cable at least:	From noise sources of this strength:
Yes	0.08m (3”)	Category-1 conductors of less than 20A
	0.15m (6”)	ac power lines of 20A or more, up to 100 KVA
	0.3m (12”)	ac power lines greater than 100 KVA
No	0.15m (6”)	Category-1 conductors of less than 20A
	0.3m (12”)	ac power lines of 20A or more, up to 100 KVA
	0.6m (24”)	ac power lines greater than 100 KVA

Wiring Inside Enclosures

Cable sections that run inside protective equipment enclosures are relatively short. As with wiring external to enclosures, you should maintain maximum separation between your ControlNet Ex cable and Category-1 conductors.

When you are running cable inside an enclosure, route conductors external to all raceways in the same enclosure, or in a raceway separate from Category-1 conductors.

Route your cable at least this distance:	From noise sources of this strength:
0.08m (3”)	Category 1 conductors of less than 20A
0.15m (6”)	ac power lines of 20A or more, up to 100 KVA
0.6m (24”)	ac power lines greater than 100 KVA

Surge Suppression

Transient electromagnetic interference (emi) can be generated whenever inductive loads such as relays, solenoids, motor starters, or motors are operated by “hard contacts” such as push-button or selector switches. These wiring guidelines assume you guard your system against the effects of transient emi by using surge-suppressors to suppress transient emi at its source.

Inductive loads switched by solid-state output devices alone do not require surge suppression. However, inductive loads of ac output modules that are in series or parallel with hard contacts require surge-suppression to protect the module output circuits as well as to suppress transient emi.

Ferrite Beads

Ferrite beads can provide additional suppression of transient emi. Fair-Rite Products Corporation manufactures a ferrite bead (part number 2643626502) which can be slipped over category-2 and category-3 (RG-6 type trunk cable) conductors. You can secure them with heat-shrink tubing or tie-wraps. A cable transient emi induced onto the cable can be suppressed by a ferrite bead located near the end of the cable. The ferrite bead will suppress the emi before it enters the equipment connected to the end of the cable.

Ordering Components

Now that you are ready to begin ordering components, use these guidelines to help you select components.

General Planning

The ControlNet Ex cable system is isolated from earth and *must* be protected from inadvertent ground connections.

Segment Planning

- all connections to the trunk cable require a tap
- taps may be installed at any location on the trunk cable
- tap drop-cable length must not be changed
- maximum number of taps = 48, with 250m (820ft) of standard RG6 trunk cable
- maximum trunk-cable length of standard RG6 trunk cable = 1000m (3280 ft), with 2 taps
- 75Ω trunk terminators are required on both ends
- one tap with an unconnected drop cable may be installed for maintenance purposes
- use BNC bullet connectors at future tap locations
- do not mix redundant and non-redundant nodes
- use ControlNet Ex tap terminators (1797-TCAP) for all other unconnected drop cables
- avoid high noise environments when routing cables
- a ferrite toroid (1797-FER) should be used on the ControlNet Ex trunk as it enters and leaves control cabinets.

Network Planning

- maximum of 99 nodes (excluding fiber repeater hubs)
- fiber repeater hubs require a tap but are not counted as nodes — they are included in the number of devices allowed per segment (48)
- fiber repeater hubs may be installed at any tap location along a segment
- there can only be one path between any two points on a network
- the configuration of both sides of a redundant segment must be the same
- the total cable difference between the two sides of a redundant network can not exceed 800m (2640ft)

Ordering Parts

The following table contains a list of ControlNet Ex Components. Refer to The ControlNet and ControlNet Ex Media System Components List (publication AG-2.2) for a list of other ControlNet parts.

Item		Cat. No.	Guidelines	Quantity needed[1]
Tap	straight T-tap straight Y-tap right angle T-tap right angle Y-tap	1797-TPS 1797-TPYS 1797-TPR 1797-TPYR	You need a tap for each connection to the trunk cable (nodes and repeaters). Each tap kit contains: two BNC connector kits, 1 dust cap, 1 universal mounting bracket, ControlNet Ex cable labels and 2 screws	*number of repeaters* x 2 + *number of nodes*
trunk terminators		1797-XT *(quantity of 50)*	You need a terminator for each end of each segment.	*number of segments* x 2
trunk cable			Use the ControlNet Ex Media System Component List publication AG-2.2 to order your required length of cable.	Follow guidelines on page 3 to determine cable length.
tap terminator		1797-TCAP *(quantity of 5)*	Use the dummy load to plug into drop cables that are not attached to a node	one for every drop cable that is not attached to a node
coax tool kit		1786-CTK	Use the tool kit to create your create your trunk cable to your specifications	one
ferrite toroid		1797-FER	Use one on the trunk cable as it extends and leaves control cabinets	1-2 per control cabinet

[1] You will need to double your quantities when ordering components for a redundant cable system.
[2] The connector kit may be shipped with two ferrules. The smaller diameter ferrule should not be used with ControlNet Ex applications.

Next

After gathering all of the parts for your ControlNet Ex cable system, you are ready to begin installing your network. Go to chapter 3.

Installing A ControlNet Ex Cable System

Contents

Follow the instructions in this chapter to install your ControlNet Ex cable system.

To:	See page:
install the trunk cable	3-1
mount the taps	3-2
install a coax repeater	3-5
install cable connectors	3-11
connect cable segments	3-21
terminate the segment	3-21
connect devices	3-22

Important: You should have read chapter 2, *Planning a ControlNet Ex Network*, before you install your network.

Installing The Trunk Cable

Install your trunk cable, observing your cable supplier's installation instructions and these guidelines.

Wiring External To Enclosures

When the RG-6 type coax cable is being pulled through multiple conduit bends, follow these specifications.

For this coax cable:	The pull strength should not exceed:	The bend radius should not exceed:
PVC	42.75kg (95lbs)	76.2mm (3.0")

Wiring Inside Enclosures

When the RG-6 type coax cable is not being pulled through conduit, follow these specifications.

For this coax cable:	The bend radius should not exceed:
PVC	38.1mm (1.5")
Tap drop-cable	25.4mm (1.0")

The 1797-EXMK Cable Marking kit is available to clearly mark drop cables and trunk cables as intrinsically safe.

Mounting The Taps

To mount the taps you:

- select where you want to mount the taps
- mount the taps

Selecting Where To Mount The Taps

- There is no spacing requirement between taps; you can install two adjacent taps if necessary by using a barrel connector (1786-BNCP).

Important: If the barrel connector (1786-BNCP) is used, either an intrinsically safe insulator or tape of 500V insulation rating must be used to cover exposed metal parts. Use of these items is necessary for intrinsically safe certification by local agencies.

- Make sure the mounting location is convenient for your cable routing.
- Make sure the mounting location does not cause any cable bend-radii to exceed the limits listed on page 3-1.
- Make sure to route your cable in accordance with intrinsically safe cable routing specifications.
- Do not mount the tap in a position that routes the drop cable over any ac power terminals on nearby modules.

ATTENTION: Do not allow any metal portions of the tap, such as the universal mounting bracket screws or connectors, to contact any conductive material. This contact could cause noise on the network.

Also to make sure all exposed metal is covered by either the intrinsically safe insulators or tape of 500V dielectric rating.

Mounting The Taps

You can mount your ControlNet Ex taps (Y-tap and T-tap):

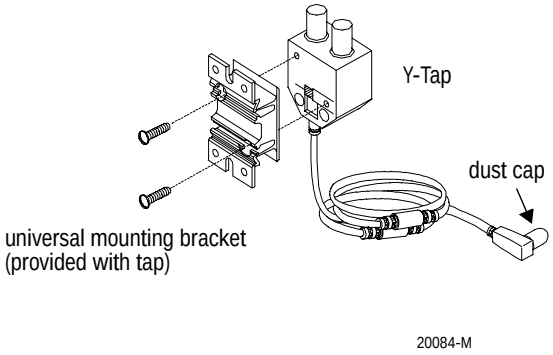
- to a universal mounting bracket, and then mount the tap and bracket as an assembly
- through the body holes in the tap using screws, flat washers, and a tie wrap

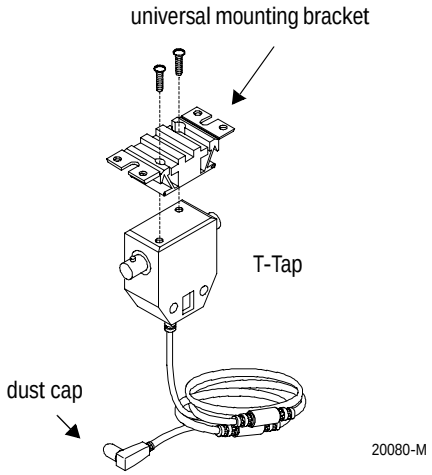
Once you have mounted your taps, you can store or discard any unused universal mounting brackets.

See appendix A for universal mounting bracket and tap mounting dimensions.

Mounting A Tap Using A Universal Mounting Bracket

1. Align the universal mounting bracket with the mounting holes on the tap.
2. Using the screws provided with the tap, attach the tap to the universal mounting bracket.





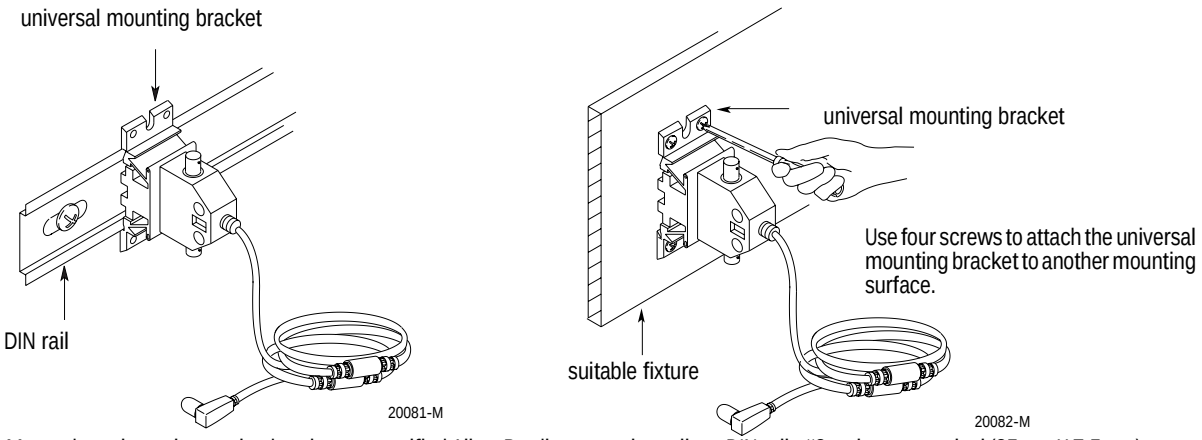
Use only the screws that are packaged with the tap. They are the proper length and head style.

ATTENTION: Do not over tighten the screws. Over tightening the screws can damage the tap. The applied torque should be 0.2-0.4 N-m (1-2 ft.-lbs).

ATTENTION: Do not remove the intrinsically safe dust cap unless the tap drop is connected to a ControlNet Ex product.

3. Mount the tap and bracket assembly to:

a DIN mounting rail **or** **another mounting surface**



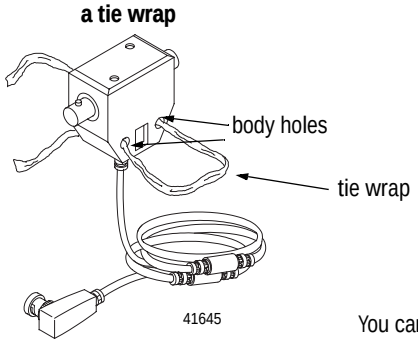
Mount the universal mounting bracket on specified Allen-Bradley mounting rails or DIN rails #3 style symmetrical (35mm X 7.5mm)

Type of rail	Cat. No.	Type of Rail	Cat. No.
A-B rail	1492-N1	DIN rail #3	199-DR1
	1492-N22		1492-DR5
	1492-N44		1492-DR6
			1492-DR7

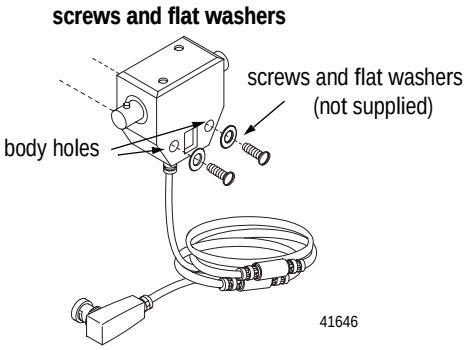
Important: The light blue intrinsically safe insulators and dust caps are provided to cover exposed metal parts. Use of these items is required for intrinsically safe system certification by local agencies.

Mounting A Tap Through The Body Holes

Mount the tap to a suitable fixture using:



or



You can use a variety of screw types.

ATTENTION: Do not over tighten the screws. Over tightening the screws can damage the tap. The applied torque should be 0.2-0.4 Nm **(1-2 ft.-lbs)**. Do not use screws larger than #8 in these holes.

Important: The suitable fixture can be conductive and/or grounded because of the electrical isolation provided by these body holes.

Specifications

The following table lists the specifications for the ControlNet Ex taps.

Operating temperature	-20 to 70°C (-4 to 158°F)
Storage temperature	-40 to 85°C (-40 to 185°F)
Relative humidity	5 to 95% noncondensing

Installing Fiber Hubs

Read the following sections before installing either a fiber repeater hub.

To install a fiber repeater hub, you:	See page:
read *Installation in Zone 1* and related intrinsically safe warnings and standards	3-5
select where to mount the fiber repeater hub	3-7
mount the fiber repeater hub	3-7

Installation in Zone 1

The 1797-RPA and -RPFM must not be exposed to the environment. Provide a separate metal enclosure. This repeater hub has a protection factor of IP20.

ATTENTION: These modules cannot be used in an intrinsically safe environment after they have been exposed to non-intrinsically safe signals.

Electrostatic Charge

Attention: Avoid electrostatic charge.

Protect the system against electrostatic charge. Post a sign near this module: **Attention! Avoid electrostatic charge.** For your convenience, a sign which can be cut out is included in this installation instruction.

European Community Directive Compliance

If this product has the CE mark it is approved for installation within the European Community or EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN50081-2
- EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN50082-2
- EMC - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

Ex Directive

This product is tested to meet the Council Directive 94/9 EC (ATEX 100a) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres by applying the following standards:

- EN50014:1992, Electrical Apparatus for Potentially Explosive Atmospheres
- EN50020:1994, Electrical Apparatus for Potentially Explosive Atmospheres - Intrinsic Safety “i”
- EN50039:1980, Electrical Apparatus for Potentially Explosive Atmospheres - Intrinsically Safe Electrical Systems “i”
- pr EN50284:1997, Special requirements for construction, test, and marking of electrical apparatus of equipment group II, category 1 G

Inputs/Outputs

Do not apply any non-intrinsically safe signals to the fiber modules.

When using as an intrinsically safe electrical apparatus according to EN50020, the European directives and regulations must be followed.

Selecting Where To Mount Fiber Repeater Hubs

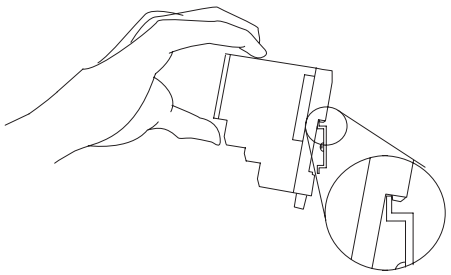
The fiber repeater hub should be mounted:

- so that air can flow in/out of the air holes on the top and bottom of the coax repeater — for proper ventilation, make sure there is a minimum of 5.1cm (2”) from surrounding equipment
- in a NEMA enclosure to provide protection from dust, moisture or corrosive atmospheres to a grounded metal plate if possible

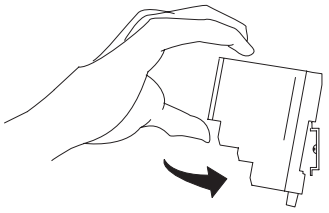
ATTENTION: Make certain that the adapter and fiber modules are secured together with DIN rail anchors. Failure to do so may result in the loss of communications and/or cause damage to the modules.

Mount the Fiber Repeater Hub

1. Position the module on a 35 x 7.5mm DIN rail (A-B part number 199-DR1) at approximately a 30° angle.



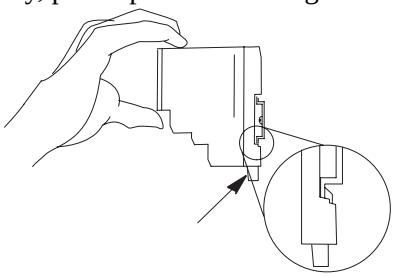
2. Hook the lip on the rear of the adapter onto the top of the DIN rail, and rotate the module onto the rail.



3. Press the adapter down onto the DIN rail until flush.

   The locking tab should snap into position and lock the module to the DIN rail.

4. If the adapter does not snap into position, use a screwdriver or similar device to move the locking tab down while pressing the module flush onto the DIN rail. Release the locking tab to lock the module in place.
   If necessary, push up on the locking tab to lock.

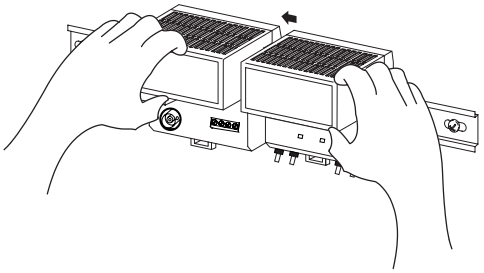


41168

5. Remove the adapter backplane connector cover.

6. Follow steps 1-4 to attach fiber modules to the DIN rail.

7. Once attached to the DIN rail, slide fiber modules to the left to mate with the adapter.



41169

Important: A DIN-rail end anchor (A-B part number 1492-EA35) must be used on the left side of the adapter and to the right side of the fiber module to keep the units from moving.

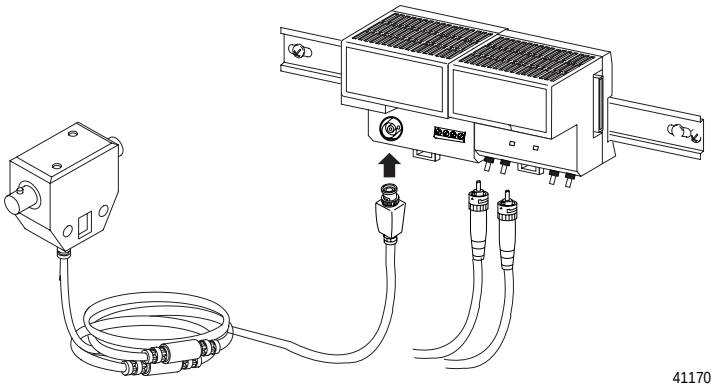
8. Make sure the last fiber module has its backplane connector cover in place.

9. Connect the adapter wiring as shown below in the “Wiring” section.

Important: You can only attach two media modules to the repeater adapter. If you exceed the module limit, you may cause damage to the adapter or fiber modules and void the IS certification.

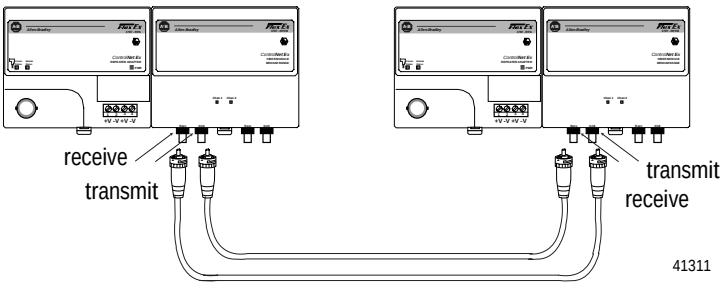
Connecting the Fiber Repeater Hub to a ControlNet Ex Network

1. Connect to the ControlNet Ex coax network by connecting the drop line of the Ex coax tap to the adapter BNC connector.



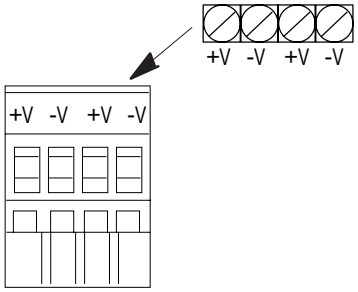
2. Connect the fiber media to the fiber module by selecting either the left or right set of receive/transmit parts and attaching the receive and transmit fibers, as appropriate.

Important: Make note of which fiber is receive and which is transmit as they must be interchanged at the opposite end.



ATTENTION: Be sure to use the blue intrinsically safe insulators on all coax BNC drop connectors as they are installed.

3. Apply +V and -V power from a 1797 power supply to the adapter through a removable terminal block.



Screw terminals and spring terminals are provided.

4. Strip the +V and -V wires to a length so no bare conductor shows after inserting the wires into position.

5. If you are using the spring terminals of the plug, insert a screwdriver into the slot and *carefully* pry until the spring clamp opens to accept the wire.

ATTENTION:

Do not use any unused terminals on this adapter. Using these terminals as supporting terminals can result in damage to the module and/or unintended operation of your system.

Make certain that you power this adapter with an intrinsically safe power supply. Do not exceed the values listed in the specifications for this adapter.

Do not remove or replace a module when power is applied. Interruption of the bus can result in unintended operation or machine motion.

Important: Make sure all fiber modules are attached and secured prior to applying intrinsically safe power to the adapter. Failure to do so may cause damage to the adapter and modules.

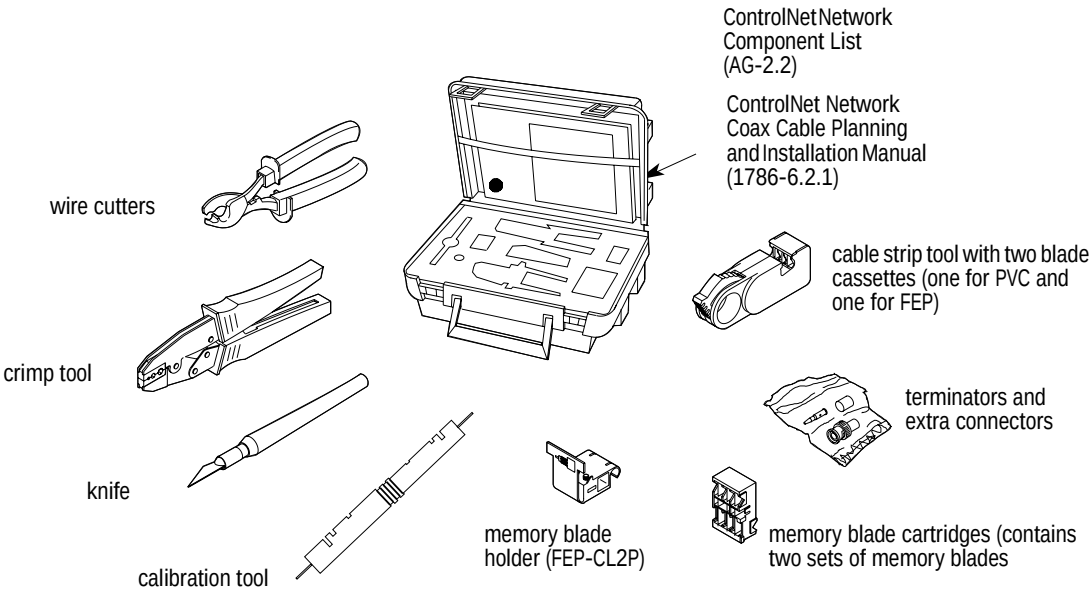
Installing Cable Connectors

After you have mounted the taps, you need to attach cable connectors to the ends of your trunk-cable sections.

To:	See page:
collect your tools	3-11
strip the cable	3-12
test for electrical shorts and continuity	3-16
attach the cable connectors	3-17
test for electrical shorts and continuity	3-20

Collecting Your Tools

To install the cable connectors, we recommend you use the tools in the ControlNet Coax Toolkit (cat. no. 1786-CTK).


ControlNet Network Component List (AG-2.2)
ControlNet Network Coax Cable Planning and Installation Manual (1786-6.2.1)
wire cutters
cable strip tool with two blade cassettes (one for PVC and one for FEP)
crimp tool
terminators and extra connectors
knife
memory blade holder (FEP-CL2P)
memory blade cartridges (contains two sets of memory blades
calibration tool

ATTENTION: Make sure to perform the calibration procedure the first time you use the tool and every time you change the blade for both memory cartridges. Refer to Appendix B for the proper calibration procedure.

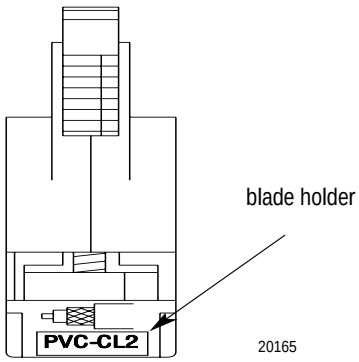
Stripping The Cable

When cutting cable sections, make them long enough to route from one tap to the next with sufficient slack so that the bend radius is not less than:

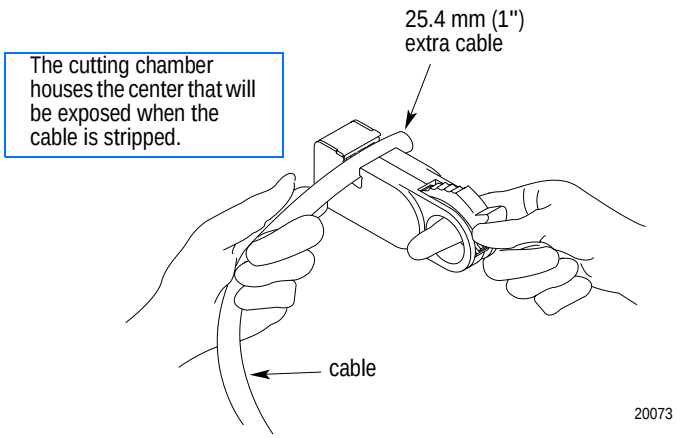
- 76.2mm (3”) for wiring external to enclosures
- 38.1mm (1.5”) for wiring inside enclosures

ATTENTION: Make sure to perform the calibration procedure the first time you use the tool and every time you change the blade for both memory cartridges. Refer to Appendix B for the proper calibration procedure.

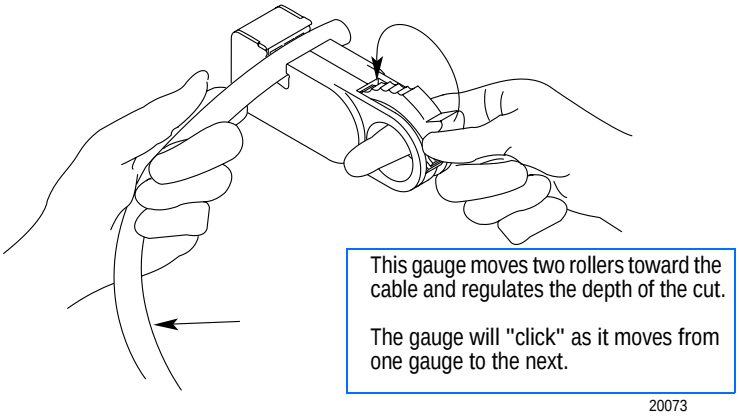
1. Verify that you have the proper memory blade holder installed for the type of cable you are using (PVC-CL2). If you need to change the memory blade holder, see appendix B.



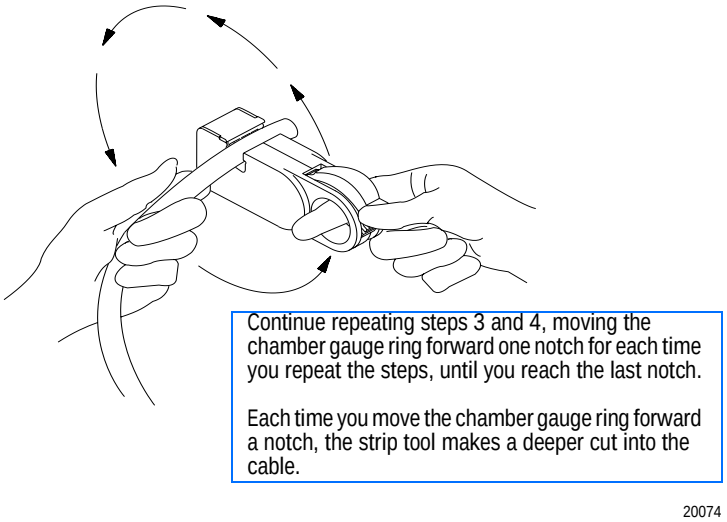
2. Insert the cable into the cable strip tool’s cutting chamber so that extra cable, approximately 25.4mm (1”), extends beyond the edge of the tool.



3. Lock the cable into place by moving the chamber-gauge ring forward until it meets the cable with slight resistance.


This gauge moves two rollers toward the cable and regulates the depth of the cut.
The gauge will "click" as it moves from one gauge to the next.
20073

4. Holding the cable in one hand, place the index finger of your other hand inside the chamber-gauge ring and turn the strip tool 360° around the cable. Make 4 or 5 full rotations until the strip tool glides easily around the cable.

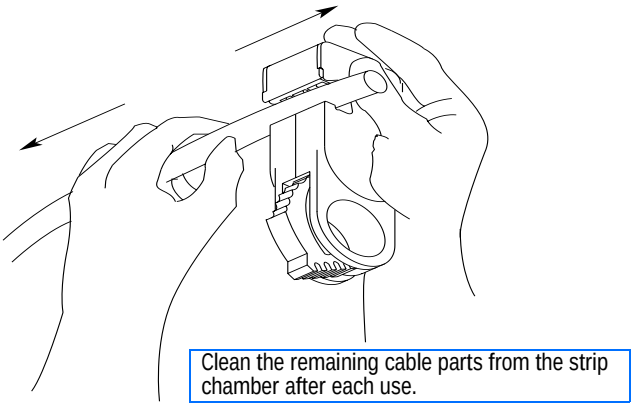

Continue repeating steps 3 and 4, moving the chamber gauge ring forward one notch for each time you repeat the steps, until you reach the last notch.
Each time you move the chamber gauge ring forward a notch, the strip tool makes a deeper cut into the cable.
20074

Important: On your last repetition of steps 3 and 4, apply sufficient pressure on the chamber gauge ring to make sure the ring has reached the last stage.

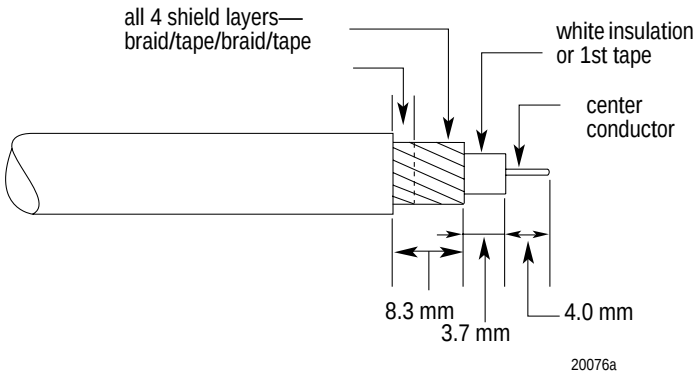
5. After you have moved the chamber gauge ring to the last position and turned the strip tool the final time:

   A. move the chamber-gauge ring backward to release the strip tool, and remove it from the cable.

   B. strip away the appropriate portion of the cable, *without using the strip tool*.



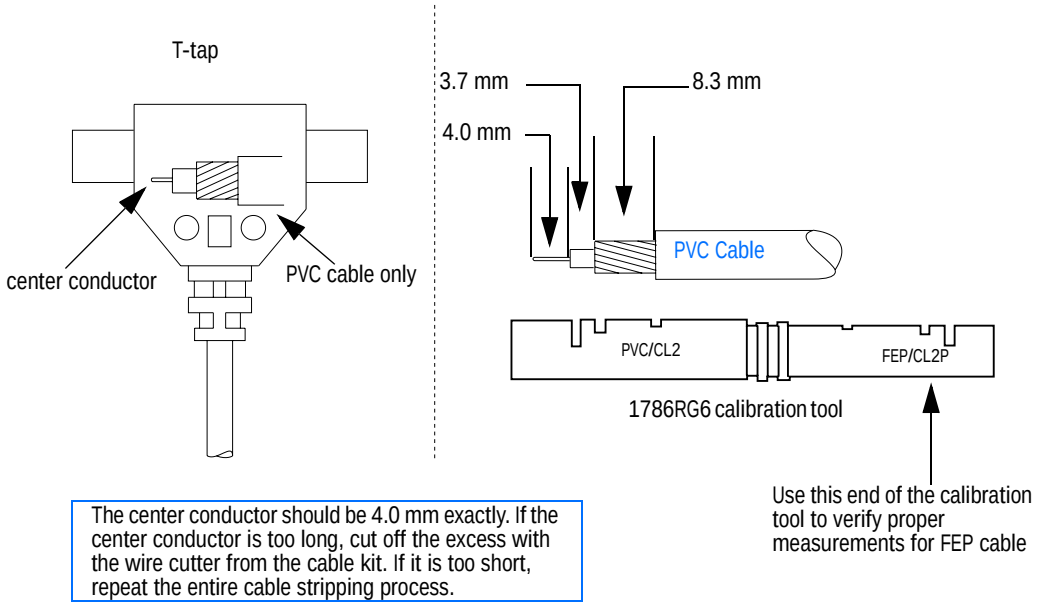
This should appropriately strip the cable, exposing these layers of the cable:



Important: If you do not see the three distinct layers of cable, snip off the exposed end with the wire cutters and repeat the entire cable-stripping process.

If stripping problems persist, the strip tool may need adjustment. See appendix B for instructions on how to adjust the strip tool.

6. Make sure the center conductor is 4.0mm. Use the imprint guide on the back of the ControlNet Ex tap or the calibration tool to verify this.

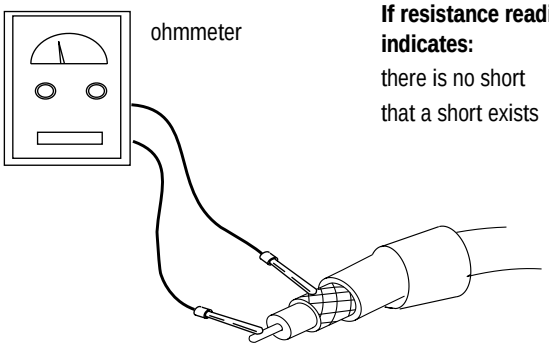


The center conductor should be 4.0 mm exactly. If the center conductor is too long, cut off the excess with the wire cutter from the cable kit. If it is too short, repeat the entire cable stripping process.

ATTENTION: Check for any braid stranding that may not have been cut at the proper length. Even one strand coming in contact with the center conductor could short out the cable. If any such strands are found, cut them to the correct length.

Testing For Electrical Shorts And Continuity

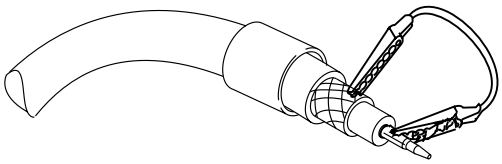
1. Using an ohmmeter or continuity tester, test for a short between the center conductor and the shield.



If resistance reading indicates:	Then:
there is no short	continue to step 2
that a short exists	inspect the ends of the cable for shorted circuits— if you are unable to locate a short, replace the trunk-cable section and repeat this test.

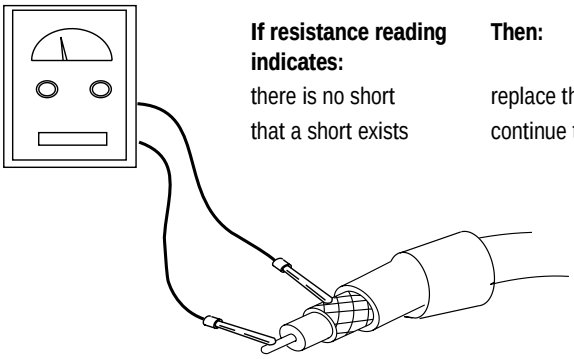
20166-i

2. Connect a temporary short between the center conductor and the shield at the opposite end of the cable.



20166-i

3. At the same end of the cable tested in step 1, use an ohmmeter or continuity tester to test for electrical continuity.

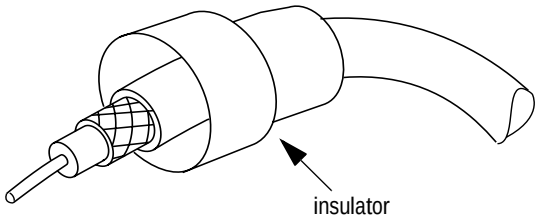


If resistance reading indicates:	Then:
there is no short	replace the trunk-cable section and repeat this process
that a short exists	continue to next section

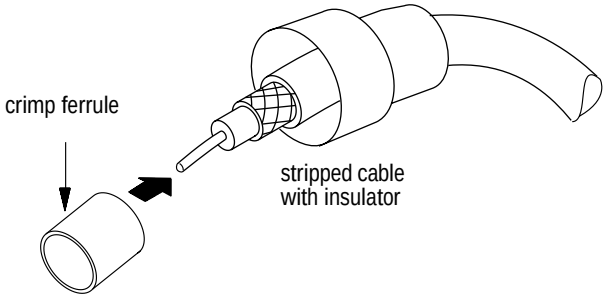
20166-i

Attaching The Connectors To The Cable

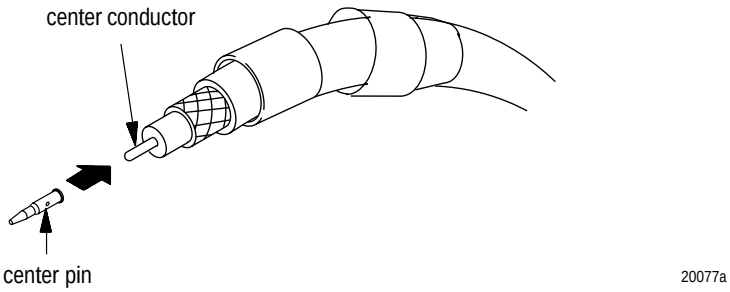
1. Slip the blue intrinsically safe insulator on the cable at the end of the cable where you are planning to place the connector.



2. Slip the crimp ferrule onto the cable. Push it back to the insulator area of the cable to keep it out of the way for the moment.

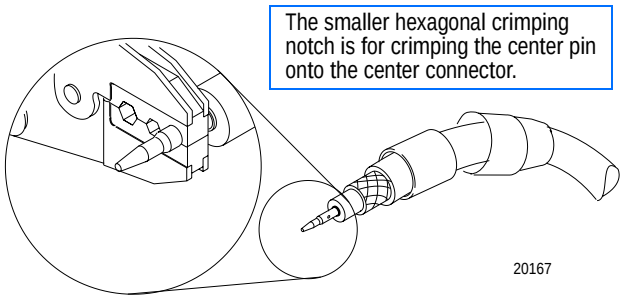


3. Place the center pin over the center conductor.

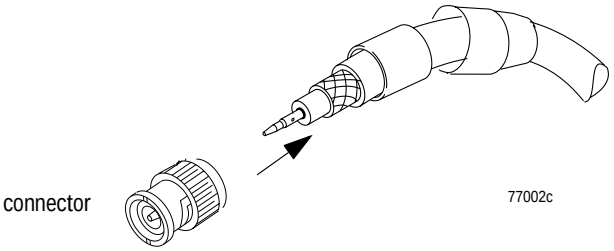


Important: Make sure that the center pin slips onto the center conductor completely. The back shoulder of the center pin should be up against the white insulation. If it is not, recheck the length of the center conductor.

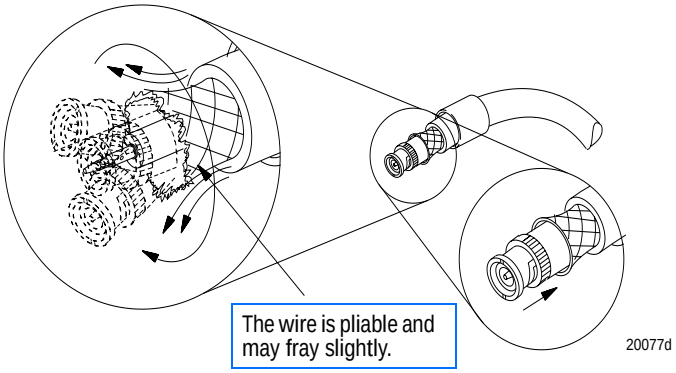
4. With the center pin in place, use the crimp tool to crimp the pin into place.



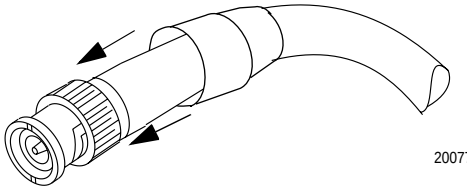
5. Slide the ControlNet Ex connector onto the cable.



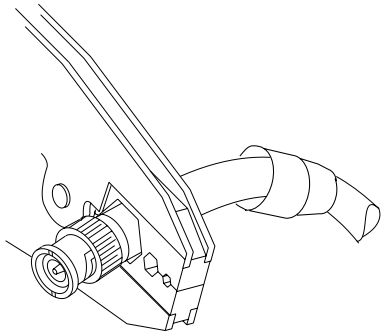
6. Move the connector in a circular motion (*without any inward pressure*) to work the connector base underneath the three outer shields. Once a gap has opened up between the inner shield tape and the three outer shields, start applying inward pressure to seat the connector base **under** the three outer shields (braid/tape/braid).



7. Slide the crimp ferrule over the three outer shields and connector base until it meets the shoulder on the connector.



8. Using the crimp tool, crimp the ferrule. Position the crimp tool on the ferrule as close as possible to the connector base and ferrule meeting line. Press the tool tightly around the ferrule until the crimp tool allows release.



The larger hexagonal crimping notch is for crimping the ferrule which holds the connector to the cable

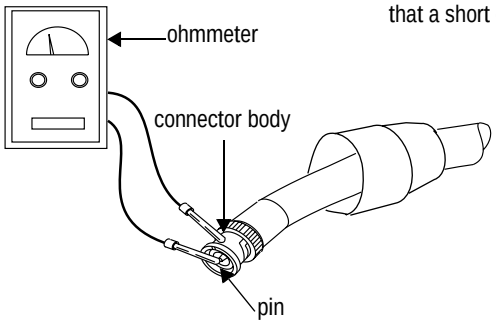
crimp ferrule

Important: Many network problems are due to improperly installed connectors. You should have tight-fitting connectors on the ends of all your cables. Pull the connector to verify that it is attached. If it is loose or comes off, snip off the connector and install a new one.

Testing For Electrical Shorts and Continuity

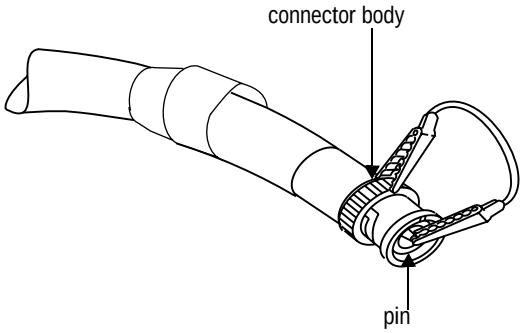
1. Using an ohmmeter or continuity tester, test for a short between the connector body and pin.

If resistance reading indicates:	Then:
there is no short	continue to next section
that a short exists	use your wire cutters to cut off the connector, install a new connector and repeat this test.



41685

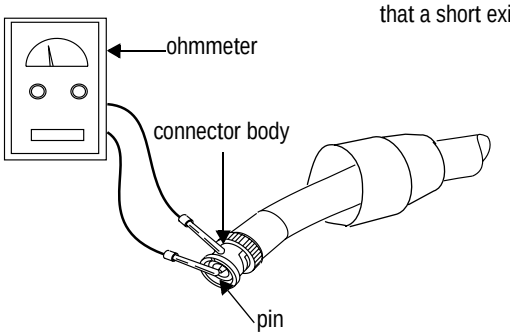
2. Connect a temporary short between the pin and connector body at the opposite end of the cable.



41686

3. At the same end of the cable tested in step 1, use an ohmmeter or continuity tester to test for electrical continuity.

If resistance reading indicates:	Then:
there is no short	continue to next section
that a short exists	use your wire cutters to cut off the connector, install a new connector and repeat this testing process.



20166

Connecting Cable Sections

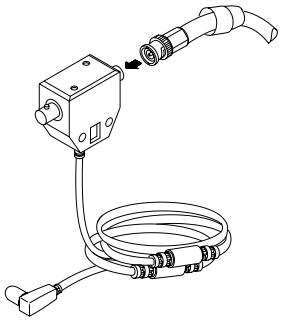
Connect the cable sections to the tap's BNC connectors and cover all exposed metal with intrinsically safe insulators.

Terminating Segments

The taps on the ends of the segment have only one cable connector attached to them. This leaves an open, or unterminated, end on the segment. Signals transmitted along the cable will reflect off these unterminated ends and interfere with transmission.

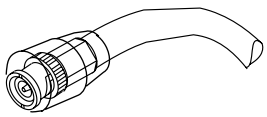
To eliminate signal reflections from the ends of the segment, you must attach a 75Ω trunk terminator (1797-XT) to the first and last taps on the segment. The terms "first" and "last" refer to the physical location of the node along the trunk cable.

1. Connect one end of the trunk-cable section to one of the tap's BNC connectors.

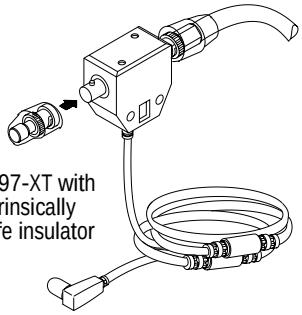


20078

2. Slide the intrinsically safe blue insulator over the BNC connector to cover any exposed metal.



3. Install a 75Ω terminator onto the tap's other BNC connector.



20079

Repeat steps 1 and 2 at the other end of the segment

ATTENTION: Make sure the intrinsically safe insulator covers all metal parts.

Connecting Devices

After terminating your segments, you connect your devices.

To connect a	See
fiber repeater hub	page 3-10
ControlNet Ex adapter	procedure below

1. Remove and save the tap's blue dust cap (located on the straight or right-angle connector).
2. Replace the dust cap with the blue intrinsically safe insulator ring.
3. Connect the tap's straight or right-angle connector to your device.

If your node supports:	Connect the tap's straight or right-angle connector:
non-redundant media	to the **channel A** connector on the device (channel B is not used)[1]
redundant media	• from **trunk cable A to channel A** on the your device • from **trunk cable B to channel B** on the your device

1 While both channels are active, Allen-Bradley recommends using channel A for non-redundant media.

Mounting Dimensions

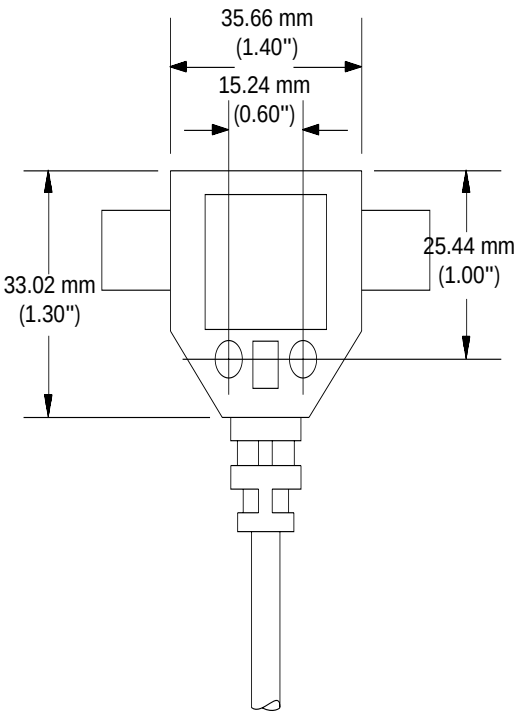
Contents

Use these mounting dimensions to mount your taps, universal mounting brackets, and repeaters.

Taps

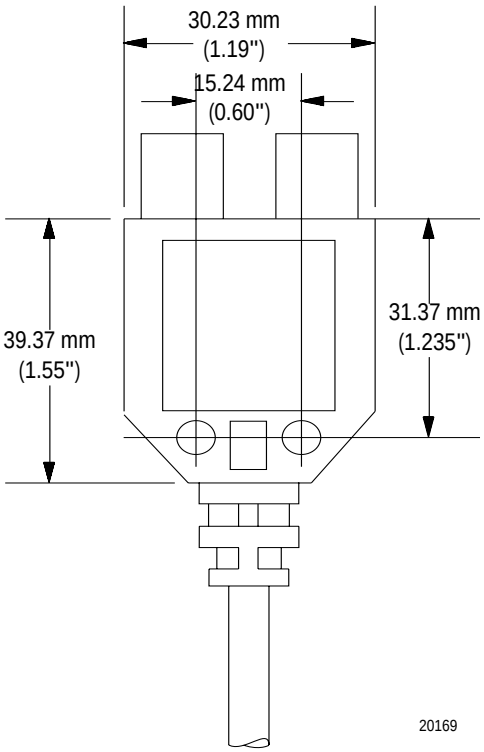
Make copies of these templates as necessary to help you mark placement for your taps.

T-tap



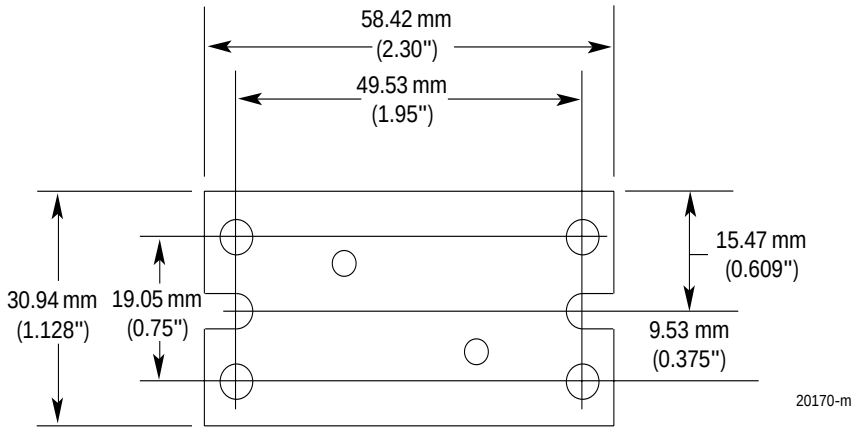
20168

Y-tap



20169

Universal Mounting Bracket



Adjusting The Cable Strip Tool

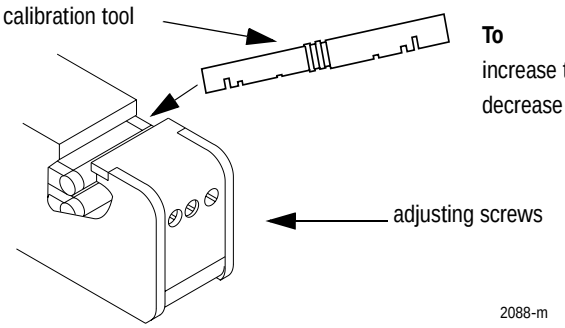
Contents

Follow the instructions in this appendix to calibrate the cable strip tool, supplied with the ControlNet Coax Toolkit (1786-CTK).

Calibrating The Cutting Blades

Use the following procedure to calibrate your cable strip tool to cut FEP or PVC cable.

1. Place the calibration tool into the cable strip tool with the narrow end installed and facing forward for FEP cable (use the wider end for PVC).



To	Turn the screw
increase the cut depth	clockwise
decrease the cut depth	counterclockwise

2. Tighten the handle of the strip tool so that the calibration tool is locked in place.

Important: When aligned properly, the grooves of the calibration tool should align with the blades.

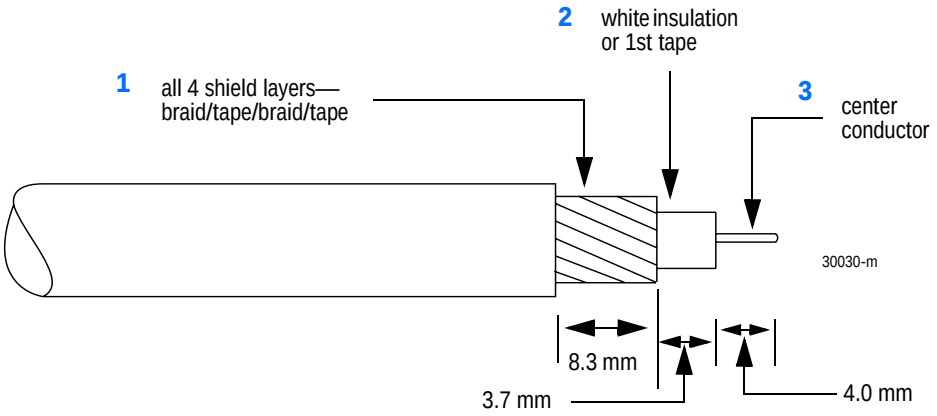
3. Adjust the screws of the memory clip so that the blades just touch the calibration tool.

ATTENTION: Do not over-tighten the screws of the cable strip tool. The blades should not bend, shift, or penetrate the calibration tool.

4. Retract the handle of the cable strip tool.

5. Remove the calibration tool from the cable strip tool.

When finished, the blade should make a cut of the following dimensions in your cable.:



1 The first cut should cut the outer sheath without cutting the outer wire braid. If the braid is frayed by the blade, adjust the blade slightly to eliminate the fraying.

2 The second cut should cut the sheath, three outer shields, and possibly the inner tape shield. The insulation can be scored slightly, but should not have a deep cut.

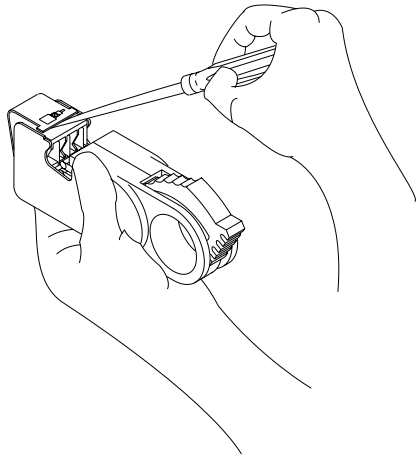
3 The third cut should cut all layers of the cable down to the center conductor. This cut should not score the center conductor. If the blade leaves a mark on the conductor, adjust the blade slightly so to eliminate marking the conductor

Important: The first and second cut adjustments need to be precise. Adjustments as small as 1/12 to 1/8 of a turn can make the difference between a perfect and an imperfect cut.

Reversing/Replacing The Cutting Blades

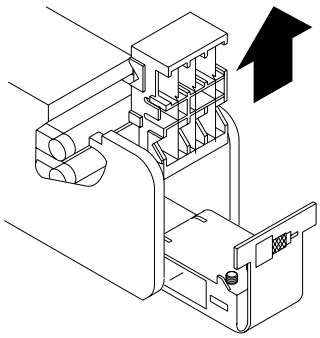
To reverse or change the cutting blades:

1. Use a screwdriver to lift the memory blade holder and swing it back.



20182-m

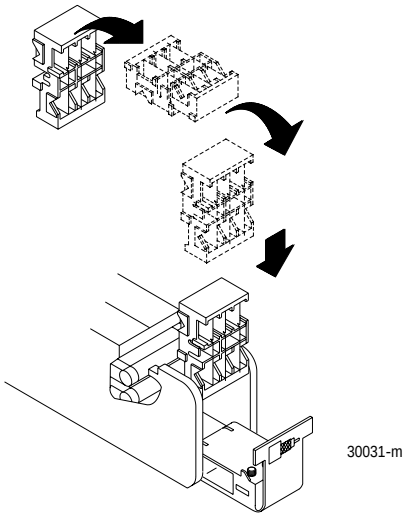
2. Slide the memory blade cartridge out of the strip tool.



20183-m

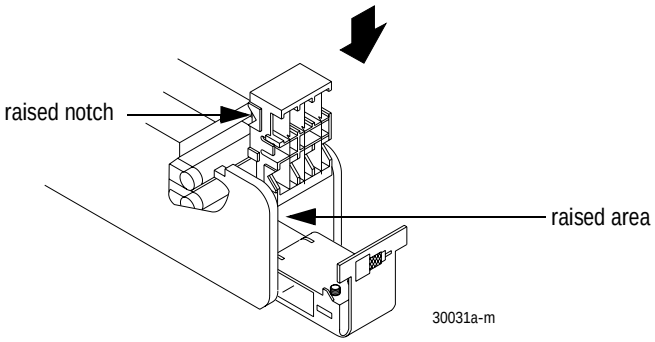
If you are	Go to
reversing the memory blade cartridge to use the second set of blades	step 3
replacing the memory blade cartridge	step 4

3. Flip the memory blade cartridge and slide it back into the strip tool.

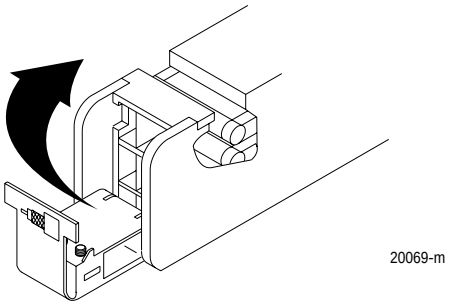


Go to step 5.

4. Align the memory blade cartridge (the side with the raised notches) to the raised area on the inside of the strip tool and slide the new memory blade cartridge in — *the blades should be on top as you slide the cartridge in.*



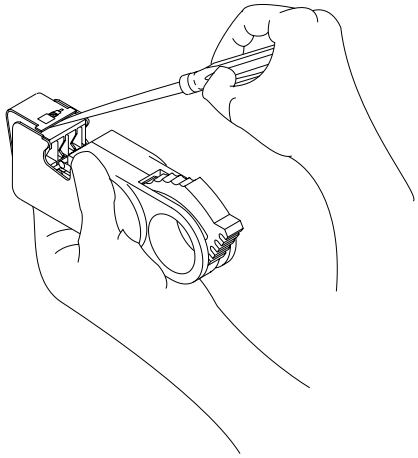
5. Swing the memory blade holder closed.



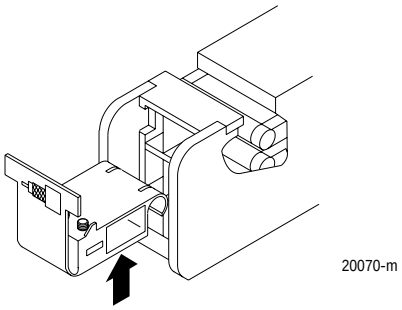
Changing The Memory Blade Holder

You received two memory blade holders with your cable strip tool; one is for PVC-CL2 cable, and the other is for plenum FEP-CL2P cable. You need to install the appropriate memory blade holder for the type of cable you are stripping (PVC or FEP).

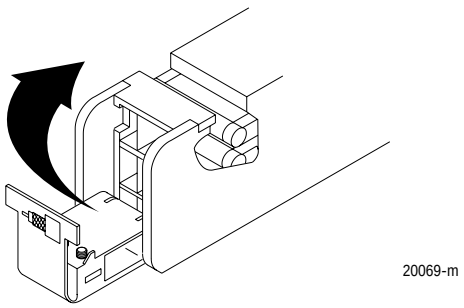
1. Lift the latches on the memory blade holder and swing it back.



2. Snap the memory blade holder off the rod and remove it from the strip tool.



3. Position the appropriate memory blade holder on the rod and snap the holder into place.
4. Swing the memory blade holder closed.



Electrostatic Charge

Protect the system against electrostatic charge. Post a sign near this module: **Attention! Avoid electrostatic charge.** For your convenience, some signs which can be cut out are included here.

Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.
Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.	Attention: Avoid electrostatic charge.

Allen-Bradley
Publication Problem Report

If you find a problem with our documentation, please complete and return this form.

Pub. Name **ControlNet Ex Media Planning and Installation Manual**

Cat. No. **1797 Series** Pub. No. **1797-6.2.1** Pub. Date **April 1999** Part No. **955133-15**

Check Problem(s) Type:	Describe Problem(s)	Internal Use Only
☐ Technical Accuracy	☐ text ☐ illustration	
☐ Completeness What information is missing?	☐ procedure/step ☐ illustration ☐ definition ☐ example ☐ guideline ☐ feature ☐ explanation ☐ other	☐ info in manual (accessibility) ☐ info not in
☐ Clarity What is unclear?		
☐ Sequence What is not in the right order?		
☐ Other Comments Use back for more comments.		

Your Name _____ Location/Phone _____

Return to: Marketing Communications, Allen-Bradley., 1 Allen-Bradley Drive, Mayfield Hts., OH 44124-6118Phone: (440) 646-3176
FAX: (440) 646-4320

Publication ICCG-5.21- August 1995 PN 955107-82

PLEASE FASTEN HERE (DO NOT STAPLE)

Other Comments

PLEASE FOLD HERE

PLEASE REMOVE

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 18235 CLEVELAND OH

POSTAGE WILL BE PAID BY THE ADDRESSEE

Rockwell Automation

Allen-Bradley

1 ALLEN BRADLEY DR
MAYFIELD HEIGHTS OH 44124-9705

A

abbreviations 4
application considerations 2-9

B

barrel connector 2-5
BNC cable connectors 1-8, 2-5
  installing 3-11
bridge 1-2
bullet connector 2-2, 2-5

C

cable connectors 1-8, 2-5
  barrel 2-5
  bullet 2-5
  installing 3-11
  isolated bulkhead 2-5
  rightangle 2-5
catalog numbers
  1770KFC 2-3
  1784KTC 2-3
  1784KTCX 2-3
  1786BNC 2-5
  1786BNCJ 2-5
  1786BNCJI 2-5
  1786BNCP 2-5, 3-2
  1786CP 2-3
  1786CTK 3-11, B-1
  1786TPR 2-14
  1786TPS 2-14
  1786TPYR 2-14
  1786TPYS 2-14
  1786XT 2-5, 2-14, 3-21
categories of conductors 2-9
coax cable 2-3
continuity tester 3-16, 3-20
ControlNet cable system
  application considerations 2-9
  attaching connectors to trunk cable 3-17
  cable connector
    bullet 2-2
  cable connectors 1-8, 2-5
    optional 1-8
  Coax Toolkit 3-11
  component definitions 1-2
  connecting cable sections 3-21
  connecting devices 3-22
  determine
    cable needed 2-3
    number of repeaters 2-5
    number of taps 2-1
    number of terminators needed 2-5
    trunkcable section lengths 2-3
    type of cable connectors needed 2-5
  ferrite beads 2-12
  installing
    cable connectors 3-11
    trunk cable 3-1
  link 2-13
  mounting taps 3-2
  network 1-2
  network access cable 2-3
  node 1-6
  ordering components 2-13
  planning guidelines 2-13
  redundant media 2-6, 2-7
  related publications 5
  repeater 1-2, 1-9, 2-5
  segment 1-2, 1-9, 2-13
  stripping trunk cable 3-12
  surge suppression 2-12
  tap 1-2, 1-7, 2-1, 2-14
    mounting dimensions A-1
  terminating segments 3-21
  terminator 2-14
  terminators 1-2, 2-5
  testing for electrical continuity 3-16, 3-20
  trunk cable 1-2, 1-7, 2-14
    testing 3-16, 3-20
    wiring 2-11
    wiring external to enclosures 2-11
    wiring inside enclosures 2-11
  trunkcable section 1-2, 1-7, 2-3
  universal mounting bracket
    mounting dimensions A-2
  wiring guidelines 2-11
ControlNet Coax Toolkit

crimp tool 3-18
strip gauge 3-15
strip tool 3-12
adjusting the cutting blades B-1
changing the memory blade holder B-5
crimp tool 3-18

F

FEP cable 4, B-5
ferrite beads 2-12

I

installing cable connectors
attaching connectors to trunk cable 3-17
stripping trunk cable 3-12
isolated bulkhead connector 2-5

L

link
planning 2-13

M

media
redundant 2-6
guidelines 2-7
memoryblade holder 3-12
mounting dimensions
tap A-1
universal mounting bracket A-2

N

network access cable 2-3
node 1-6

O

ohmmeter 3-16, 3-20
ordering components 2-13

P

programming terminals
ways to connect to a ControlNet link 2-3
publications 5
17704.1 2-11
AG2.2 1-6, 2-5
PVC cable 4, 3-1, 3-12, B-5

R

redundant media 2-6
guidelines 2-7
repeater 1-2, 1-9, 2-5
selecting where to mount 3-7
RG6 cable 2-3, 3-1
rightangle connector 2-5

S

segment 1-2, 1-9
planning 2-13
terminating 3-21
strip tool
adjusting the cutting blades B-1
changing the memory blade holder B-5
reversing/replacing cutting blades B-3
surge suppression 2-12

T

tap 1-2, 1-7, 2-14
determine number needed 2-1
mounting 3-2
to a universal mounting bracket 3-3
using the body holes 3-5
mounting dimensions A-1
selecting where to mount 3-2
terminators 1-2, 2-5
trunk cable 1-2, 1-7
attaching cable connectors 3-17
bend radius 3-1
installing 3-1
pull strength 3-1
stripping 3-12
terminating 3-21
testing for shorts and continuity 3-16, 3-20
wiring external to enclosures 2-11, 3-1
wiring inside enclosures 2-11, 3-1
trunkcable section 1-2, 1-7, 2-3, 3-21

U

universal mounting bracket
mounting dimensions A-2

W

wiring
external to enclosures 2-11, 3-1
inside enclosures 2-11, 3-1
wiring guidelines 2-11

Reach us now at www.rockwellautomation.com

Wherever you need us, Rockwell Automation brings together leading brands in industrial automation including Allen-Bradley controls, Reliance Electric power transmission products, Dodge mechanical power transmission components, and Rockwell Software. Rockwell Automation's unique, flexible approach to helping customers achieve a competitive advantage is supported by thousands of authorized partners, distributors and system integrators around the world.

Americas Headquarters, 1201 South Second Street, Milwaukee, WI 53204, USA, Tel: (1) 414 382-2000, Fax: (1) 414 382-4444
European Headquarters SA/NV, avenue Herrmann Debroux, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Rockwell Automation

Publication 1797-6.2.1 - April 1999

PN 955133-15

© (1999) Rockwell International Corporation. Printed in the U.S.A.